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THE 1ST INTERNATIONAL SEMINAR ON SCIENCE AND TECHNOLOGY

Contributing Science ang Technology
for Enhancement of Nation's Productivity and Competitiveness

Surabaya, Indonesia , August 5th, 2015

POSTGRADUATE OF ITS

Organized by :

Departement of Engineering Physics

2015

Teknik Fisika

ISST 2015

Kumamoto University

United Nations Educational, Scientific and Cultural Organization

INTERNATIONAL YEAR OF LIGHT 2015

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PROCEEDING

1st INTERNATIONAL SEMINAR ON SCIENCE AND TECHNOLOGY 2015

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Contributing Science and Technology for Enhancement of Nation's Productivity and Competitiveness

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Pascasarjana Building, ITS Campus Sukolilo, Surabaya, Indonesia

Organized by:

Engineering Physics, Faculty of Industrial Technology

Postgraduate Program Institut Teknologi Sepuluh Nopember

2015

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Welcoming Speech from Rector of ITS

Assalamualaikum Wr. Wb.

Ladies and Gentlemen, allow me in this opportunity to welcome all of this conference participants by first praying our grateful and praise to the Almighty God for all His blessings, grace, and mercies that have made us possible to gather here in this room in excellent condition and health.

Dear keynote speakers, distinguished guests and participants of the First International Seminar on Science and Technology (ISST) with topic on ***Contributing Science and Technology for Enhancement Nation's Productivity and Competitiveness***" Institut Teknologi Sepuluh Nopember (ITS) is very pleased to host this conference in Surabaya. Welcome to ITS Campus. Welcome to Surabaya city.

The world today is facing many challenges. We must address the sustainability agenda to deliver improvements in efficiency and resource productivity. Together with the public and private sectors, non-governmental and intergovernmental organizations, scientists, engineers are responsible to build a better life and safety for society through the application of knowledge to convert resources into products and services without compromising the ability of future generations to cope with their needs.

We should be clearly aware of the importance of interdisciplinary cooperation. We need to promote cooperation within the profession and also with natural and social scientists and the public in the creation and application of knowledge for enhancing nation productivity and competitiveness. Curriculum and pedagogical reform in engineering education and continuous professional development to encompass wider social and ethical concerns are needed. International cooperation in engineering facilitates the exchange of knowledge and promotes technological applications for safer and well-being future to support human life sustainability.

In accordance with the vision and mission of ITS, that is to become a world-class research university, this international conference is one among many efforts to make these vision and mission come true. This year conference is held to celebrate the 55rd anniversary of ITS. It is part of our concern on contribution of science and technology for enhancing nation productivity and competitiveness in Indonesia. Hopefully, we all can significantly give more contributions to the nation advancement in the not-too-distance future. To all of our distinguished guests and participants, thank you for being here, welcome, and enjoy the conference!

Wassalamualaikum Wr. Wb.

Prof. Ir. Joni Hermana, M.Sc.Es, PhD.
Rector of ITS, Surabaya, Indonesia

Welcoming Speech from Director of Post Graduate ITS

Assalamualaikum Wr. Wb.

I am sincerely glad to welcome all you here, especially as I see very many familiar persons, colleagues, friends, and our partners. Welcome to ITS.

In the first place, I would like to praise God for His blessings and mercies which allow all of us to be here today in this building in the very good shape. I wish to express our deepest appreciation to those who have come from far away; many of them having been involved in commencing exactly what we have gathered here for.

On behalf of the Post Graduate of ITS, it would be our great pleasure to welcome all of you, keynote speakers, invited speakers, post graduate students, experts, scientists, engineers, and professional researchers from all over the universities. The 1th ISST 2015 is a scientific forum where all of us could meet students, colleagues and friends of broad areas and to discuss and disseminate research findings and discoveries as well as to develop knowledge, science, and technology, and research networks, which in turn would, of course, contribute to enhancing nation productivity and competitiveness. For this reason, this year conference addresses a very important theme on ***Contributing Science and Technology for Enhancement Nation's Productivity and Competitiveness.*** Therefore, it is a great pleasure and beneficial for all of us here today if we are able to take this advantage to build strong sustainable networks among researchers in order to develop knowledge, technology through recent research and innovation.

By hosting this conference, Post Graduate ITS is not only gaining the advancement of science and technology from all the findings and discoveries delivered during the conference.

Finally, I would like to convey our sincere gratitude to keynote speakers, all participants, distinguished guests, and speakers that make this conference a great success. Thank you very much for being here. Also, thank to Engineering Physics Department, who has prepared for the conference, thank you very much for your hard and untiring efforts.

The conference is an annual event which is held near the end of the year. We do hope that we could welcome you again next year in the 2nd ISST 2016, which certainly offers the most recent topics, cutting-edge technologies, as well as advance science and technology in various areas.

I wish you enjoy a very successful, productive, and inspiring conference!

Wassalamualaikum Wr. Wb.

Prof. Dr. Ir. Adi Soeprijanto, M.T.
Director of Postgraduate Programme ITS

Welcoming Speech from Chair of Organizing Commitee

Honorable Rector of Institut Teknologi SepuluhNopember (ITS), Prof. Ir. Joni Hermana, MSc.Es, PhD,

Honorable Director of Post Graduate Program ITS, Prof. Dr. Ir. Adi Soeprijanto, MT.

Honorable Keynote, invited Speakers and Participants,

Distinguished Delegates, Guests, Ladies and Gentlemen,

Dear colleagues,

Assalamualaikum. Wr. Wb.

On behalf of ITS, allow me to deliver this welcome speech.

At this precious moment, let me first express our sincere gratitude to God, who has granted us with blessings and grace that we could gather here today to attend the First International Seminar on Science and Technology. Let me extend my warmest greetings and welcome to particularly the keynote speakers from abroad Prof. Azzedine Boudrioua and Prof. Tsuyoshi Usagawa, and participants. It is both a pleasure and honor for me to welcome you all to the 1st international seminar on science and technology 2015.

This seminar is the first international seminar which is the continuation of annual post graduate national seminar. This seminar is organized as an event for current research results desemination from graduate students, faculty members, researchers, and also academia from various universities and research institutions. In accordance to this year's theme, this seminar will cover a wide range of sustainable design and technology issues, especially state of the art information and knowledge of new innovations, ideas, creative methods or applications which can be implemented to enhance the human life and environment. Serving as a platform for science and technology dialogue, this seminar will have 2 keynote speakers from Japan and France and 4 invited speakers delivered by Institut Teknologi Sepuluh Nopember young researchers. Moreover, this seminar has gathered 112 oral presentations. Selected authors will be invited to submit their full paper to IPTEK Journal of Proceeding series.

This seminar will be divided into three sessions, the first session is the keynote speakers presentations, the second session will be invited speakers presentation, and the last session is presentation by participants.

My deepest gratitude to all of our speakers, participants and contributors who have given this seminar their generous support. I would like also to thank to all members of the Steering Committee, Scientific Committee and Organizing Committee and our distinguished international board of reviewers for all their support and advice. We also owe our success to the full support of the Rector of Institut Teknologi Sepuluh Nopember and the Director of the Postgraduate Program.

Allow me to wish all of you a meaningful and rewarding seminar. Thank you and we hope to see you again at the ISST 2016.

Thank you.
Wassalamualaikum Wr. Wb

Dr. Ir. Aulia Siti Aisjah, M.T.
Chair of Organizing Committee

Speaker Azzedine Boudrioua
Université Paris 13
France

Azzedine Boudrioua is a Professor at the University Paris 13. He is leading Organic Photonics and Nanostructures group of *Laboratoire de Physique des Lasers* (LPL) at Galilee Institute. After a M. Sc. in Physics from the University of Annaba (1990, Algeria), he prepared a Ph. D. in Physics at the University of Metz in France (1996) where he conducted, for 15 years, his research in the field of integrated optics and photonic crystals as an Associated Professor. In 1997, he joined the group of Professor W. L. Barnes at Exeter University (UK) as a fellowship researcher where he worked on microstructured luminescent polymers. Four years later (2001) he defended his *Habilitation à Diriger des Recherches* (HDR) at the University of Metz. Since 2007, he is a full Professor at the University Paris 13. He is currently developing activities in the field of nanophotonics as well as nonlinear optics. He was involved in the organization of several conferences. In particular, he was the chairman of the National conference on guided optics (JNOG) 2006 and the French Optical Society Congress "*Optique Paris 2013*" in 2013. He participates to several national and international scientific committees and expert panels.

Azzedine Boudrioua has published more than 80 journal papers and more than 100 papers presented in national and international conferences. He also published two books on Integrated Optics and one book on Organic Lasers is under publication. He is a member of the French Optical Society board and a Vice President of the Optical and Photonics Algerian Society. In addition to that, he is involved in several national and international projects and he is leading some of them. More recently, he was appointed by the international steering committee of the International Year of Light 2015 as a coordinator of Ibn al Haytham International Working Group.

Speaker Tsuyoshi Usugawa
University of Kumamoto
Japan

Tsuyoshi Usagawa received the B.E. from Kyushu Institute of Technology in 1981and the M.E. degree from Tohoku University in 1983. He joined Kumamoto University in 1983 and he received his Dr. Eng. Degree from Tohoku University in 1988. Since 2004 he is a professor of Graduate School of Science and Technology, Kumamoto University. He is active in the field of acoustic signal processing and ICT-based education. He was a Director of Center of Multi Media and Information Technologies during 2004-2010. During his duty, he joined the activity to establish the Graduate School of Instructional System, Kumamoto University, which is the first graduate school in Japan to focus on the e-Learning professional by complete distance-learning style. Also he was the leader of JICA PREDICT-ITS phase 1 and phase 2 projects during 2006-2014.He is a member of IEEE, ASA, ACM, ASJ, INCE/J, IEICE, JSET, etc

Speaker Siti Machmudah
Department of Chemical Engineering
Institut Teknologi Sepuluh Nopember

Siti Machmudah is a lecturer in Department of Chemical Engineering, Institut Teknologi Sepuluh Nopember, Indonesia. After graduate from Bachelor Degree in Chemical Engineering Department, ITS, Indonesia (1998), she graduated from her Master Degree in Graduate School of Science and Technology, Kumamoto University, Japan (2005). She graduated fro doctoral degree in three years (2008) from Kumamoto University.

Siti Machmudah is known as a lecturer in Department of Chemical Engineering, Institut Teknologi Sepuluh Nopember since 1998. After graduated from doctoral degree in Japan, she also known as reseacher in Bioelectric Researcher Center, Kumamoto University (April, 2008 – March, 2009), researcher in Department of Chemical Engineering, Nagoya University (April, 2012 – Marcch, 2014). Her reasearch is concern in **Bioelectric**. As in April 2009 until March 2011 she becam a Japan Society for the Promotion of Science (JSPS) prostdoctoral research fellow in Bioelectric Research Center in Kumamoto University. She also became a postdoctoral researcher in Bioelectric Research Center of Kumamoto University. Because she is a researcher, Siti Machmudah has publised 62 international journal papers.

Speaker Ridho Bayuaji
Department of Civil Engineering
Institut Teknologi Sepuluh Nopember

Ridho Bayuaji is lecturer at Concrete Technology and researcher at Laboratory of Material Testing in Civil Engineering Department, Faculty of Civil Engineering and Planning, ITS – Surabaya.

His research interests are: hydration and microstructure of concrete materials, incorporation of waste and alternative materials into current building materials, durability and structural performance of alternative and natural building materials, geopolymer concrete, green material Technology, cement replacement material, lightweight concrete, coaching in Civil Engineering program. In 2015, he is currently developing research consortium green material in Geopolymer Research Consortium Indonesia (KORIGI)

Speaker Sri Fatmawati
Department of Chemistry
Institut Teknologi Sepuluh Nopember

Sri Fatmawati is assistant professor at Laboratory of Natural Product and Chemical Synthesis, Department of Chemistry, Faculty of Mathematics and Natural Sciences, ITS – Surabaya. She obtained her MSc and PhD from Kyushu University, Japan. She is reviewer of some national and international journals. She also received more than 10 honors and awards both national and international, such as: **Faculty for The Future Award, 2012 from** *Schlumberger Foundation – Netherlands,* **International L'Oreal-UNESCO For Women in Science (FWIS) 2013** from *L'Oreal-UNESCO – Paris, France.* **People of The Year 2013 kategori "Tokoh Muda Indonesia"**from *Koran Sindo (Seputar Indonesia, MNC Group),* **The best five Ristek – Kalbe Farma Young Scientist Award 2014**from *Ministry of Research and Technology-Indonesia and Kalbe Farma Tbk,* **Inspiring female scientist from Indonesia** from *Euraxess Links ASEAN E-newsletter, March edition* 2015 and KARTINI AWARD "**The Most Inspiring Woman**" Surabaya Suite Hotel, Surabaya – Indonesia in April 2015. She is particularly interested in natural products and medicinal chemistry.

Speaker Totok Ruki Biyanto
Department of Engineering Physics
Institut Teknologi Sepuluh Nopember

Totok R. Biyanto (TRB) is accociate professor at Instrumentation, Process Control and Optimization, Department of Engineering Physics, Faculty of Industrial Engineering, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia.
He completed his PhD from University of Petronas Malaysia. His research and teaching interests are instrumentation, advanced process control and optimization for oil and gas, petrochemical, cement, powerplant, and general industires, green building, energy effisiency and conservation, heat integration, and plant design.

Kumamoto University

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ISST 2015 SCHEDULE

Time	Scheduled
Wednesday, August 5th, 2015	**Venue: Pascasarjana Bulding ITS**
07.30 – 08.30	Registration
08.30 – 09.00	**ISST 2015 Opening Ceremony** Remark from Committee (Dr. Aulia Siti Aisjah) Official welcome from Director of Post Graduate Program ITS (Prof. Adi Supriyanto) Official welcome & opening from Rector ITS (Prof. Joni Hermana) Overview the program
09.00 – 09.20	Coffee Break
09.20 – 10.00	1st Keynote Speaker: Prof. Azzedine Boudrioua *Science and Technology of Light: recent developments and future directions* Moderator: Dr.rer.nat Aulia MT Nasution
10.00 - 10.40	2nd Keynote speaker: Prof. Tsuyoshi Usagawa *Potential of e-Learning for enhancing graduate and undergraduate education* Moderator: Dr. Dhany Arifianto
10.40 – 12.00	Invited Speaker 1: Dr. Siti Machmudah *Research Opportunities in Japanese Universities and Tips for Scientific Publications* Invited Speaker 2: Dr. Ridho Bayuaji *Utilization of Local Materials in Green Concrete Technology* Invited Speaker 3: Dr. Sri Fatmawati *An Overview of Ganoderma lingzhi Constituents on α-Glucosidase and Aldose Reductase Inhibitory Activity* Invited Speaker 4: Dr. Totok Ruki Biyanto *Green Concept in Engineering Practice* Moderator: Dr. Bambang Lelono
12.00 – 13.00	Break, lunch and pray
13.00 - 15.00	Parallel sessions
15.00 – 15.30	Coffee break and pray
15.30 – 16.30	Parallel sessions
16.30 – 16.45	Announcement of the Best Paper and Closing Ceremony
16.45 – 17.00	Certificate Distribution

Room A

Time	Code	Title and Authors
13.00-13.15	A-101	Simulation Bursting Effects To The Performance Vertical Axiz River Turbine Using Computational Fluid Dynamics *Aank Suseno, Hantoro Ridho, Gunawan Nugroho*
13.15-13.30	A-102	Optimization of Flash Steam Geothermal Power Plant in Indonesia *Daril Ridho Zuchrillah, Renanto Handogo, Juwari Purwo Sutikno*
13.30-13.45	A-103	Economical Aspect of Heat Exchanger Cleaning Affected by Fouling *Mades Darul Khairansyah, Totok R. Biyanto*
13.45-14.00	A-104	Cost Optimization In Scheduling On Cleaning Heat Exchanger *David Licindo, Renanto Handogo, Juwari Purwo Sutikno*
14.00-14.15	A-105	Optimization of CO2 Contents and Energy Saving on Sweetening Gas Processing Plant Using Algorithm Particle Swarm Optimization (PSO) *Sisca Dina Nur Nahdliyah, Totok R. Biyanto*
14.15-14.30	A-106	Design Of Solar Distillation Type Double Slope With The Addition Of Triangular Waveform Absorber Plate And Internal Reflektor *Oktavianus Ama Ki'I, Endarko*
14.30-14.45	A-107	QM/MM dynamics of Proton Transport in Chitosan/Phosphotungstic Acid Composite Membrane for Direct Methanol Fuel Cell *Linda Windia Sundarti, Lukman Atmaja, I Gusti Made Sanjaya*
14.45-15.00	A-108	Enhancement Concentration of Bioethanol Through Packed Sieve Tray Distillation *Fadlilatul Taufany, I G. N. Pranata Adi Putra, Rydho Jalu Nuringtyas*
15.00-15.30		Coffee Break and Pray
15.30-15.45	A-109	Impact of Biogas Purification System on Generated Power in Gas Engine Generator *Fadlilatul Taufany, Bobby Rama Jaya R, Ardhiya*
15.45-16.00	A-111	Simulation of Solar-Assisted Single Stage Absorbtion Chiller as Ice Maker Based on MATLAB *Ridho Hanroto, Dwi Ganef Janesa*
16.00-16.15	A-112	Determination Analysis of Dish Collector Focal Shape in Vertical and Horizontal Direction to Know Performances of Concentrating Solar Power System *Dany Iman Santoso, Djatmiko Ichsani*

Room B

Time	Code	Title and Authors
13.00-13.15	B-113	Used Cooking Oil Esterification Heterogeneous Acid Catalysts As Biodiesel In Making Learning Materials In Laboratory *Nungky Purwasusanti, Ratna Ediati*

13.15-13.30	B-114	Waste Power Plant Modeling Based Landfill Pretreatment and HCCI (Homogeneous Charge Compression Ignition) Generator Engine *Wahyu Hendra W, Gunawan Nugroho*
13.30-13.45	B-115	Model Based Controller With Internal Model Control (IMC) Which Tunning By Set Point and Disturbance on Power Plant Based HYSYS *Hendrik Elvian Gayuh Prasetya, Totok R. Biyanto*
13.45-14.00	B-201	Evaluation Of The Suitability Of Urban Parks Based On The Characteristic Of The Elderly's Needs In Surabaya *Anindita Ramadhani, Endang Titi Sunarti Darjosanjoto, Murni Rachmawati*
14.00-14.15	B-202	Waste Transportation System Optimization on Azzahara Material Recovery Facility (MRF) Bengkulu City *Rendra Satria, Putu Artama, Joni Hermana*
14.15-14.30	B-203	The Arrangement Of Downtown Area As Effort To Represent Identity Of Ambon [Case Study: A. Y. Patty Street Area] *Kreisson Pisty Larwuy, Endang Titi Sunarti Darjosanjoto, Murni Rachmawati*
14.30-14.45	B-204	Prospects Of Property In Chinatown Surabaya (Case Study: Kya-Kya Surabaya) *Ni Wayan Anantasia Saraswati, Purwanita Setijanti, Murni Rachmawati*
14.45-15.00	B-205	Space Acculturation of The Settlement around Sumenep Palace, Madura *Mehdia Iffah Nailufar, Muhammad Faqih, Murni Rachmawati*
15.00-15.30		Coffee Break and Pray
15.30-15.45	B-206	The Partnership Benefits in Low-cost Apartment Implementation Program in Surabaya Metropolitan Area *Muntoha M, Soemitro R.A.A, Rahmawati F*
15.45-16.00	B-207	The Spatial Consequences of High-Rise Building Upon The Public Space of Basuki Rahmat Corridor, Surabaya *Annisa Budhiyani Tribhuwaneswari, Endang Titi Sunarti Darjosanjoto, Murni Rachmawati*
16.00-16.15	B-208	PVDF/TiO2/PEG Hollow Fiber Membrane for Oily Wastewater Treatment at Various Concentration of Oily Wastewater *Fithri Yatul Humairo, Chi Siang Ong, Nurul Widiastuti, Ahmad Fauzi Ismail, Shabrina Adani Putri, Juhana Jafar*
16.15-16.30	B-209	The Effects of Mechanical Milling and Nb-Based Additives on the Kinetics Sorption Properties of 2LiBH4-MgH2 *Farhanah Marwan, Raphaël Janot, Jean-Noël Chotard*

Room C

Time	Code	Title and Authors
13.00-13.15	C-210	PVDF/PEG/TiO2 Hollow Fiber Membrane for Lead(II) Removal *Shabrina Adani Putri, Fithri Yatul Humairo, Chi Siang Ong, Nurul Widiastuti, Juhana Jaafar, Ahmad Fauzi Ismail*
13.15-13.30	C-211	Surabaya Sub-Urban's Housing Development Strategy With Community-Based Ecotourism Approach. Study Case: Kampung Jambangan Surabaya,

		Indonesia *Fransiska Ines Setyawati, Muhammad Faqih, Purwanita Setijanti*
13.30-13.45	C-212	Arrangement Concept Of Fishermen's Settlement In Wonorejo Surabaya To Support The Mangrove Ecotourism *Putu Laras Pradnya Pramesti, Ispurwono Soemarno, Ima Defiana*
13.45-14.00	C-213	Characteristics of Fishermen Communities in The Coastal of East Balikpapan *Tiara Irawanti, Eko Budi Santoso, Haryo Sulistyarso*
14.00-14.15	C-214	Spatial Modelling Of Religious Tourism Development Strategy with Special Reference of Aer Mata Cemetery Bangkalan Madura, Indonesia *Katherine E.D.P. Permanasari, Endang Titi Sunarti Darjosanjoto, Murni Rachmawati*
14.15-14.30	C-215	Identification Of Subsurface Structures Area Of Wisata Pemandian Air Panas Tahura R Soerjo Garden In Cangar Used VlLFEM Method *Rosdiana Yoku, Eko Minarto*
14.30-14.45	C-216	3D Seismic Tomography Imaging of Taiwan Substructure *Susi Anggraini Diah Ningrum, Bagus Jaya Santosa*
14.45-15.00	C-217	The SFA-LSSVM as a Decision Support System for Mitigating Liquefaction Disasters *Julian Pratama Putra Thedja, Jui-Sheng Chou, Tri Joko Wahyu Adi*
15.00-15.30		Coffee Break and Pray
15.30-15.45	C-218	The Effect of Green Building Application to Property Value *Fitri Rahmawati, Christiono Utomo, Purwanita Setijanti* *Yeptadian Sari, Christiono Utomo, Purwanita Setijanti*
15.45-16.00	C-220	Modeling Of Poverty In East Java Province With Spatial Seemingly Unrelated Regression (Sur-Spatial) *Dibyo adi wibowo, Setiawan, Vita Ratnasari*

Room D

Time	Code	Title and Authors
13.00-13.15	D-301	A Review on User Perception of Desktop and Mobile Service Website Using Webqual and User Experience Approach *Rizqiyatul Khoiriyah, Apol Pribadi Subriadi*
13.15-13.30	D-302	Kinect Depth Image Processing for Hand Motion Recognition using Neural Network Backpropagation *Syamsiar Kautsar, Purwadi A. Darwito*
13.30-13.45	D-303	Self Tuning Sliding Mode Control for Quadrotor Waypoint Tracking *Swadexi Istiqphara, Trihastuti Agustinah, Ali Fatoni*
13.45-14.00	D-304	Analysis of N-nitrosodiprophylamines Carcinogenic Compound to Meat-Processing using Headspace-Single Drop Microextraction-Gas Chromatography-Flame Ionization Detector (HS-SDME-GC-FID) *Teguh Hari Sucipto, Ganden Supriyanto, Yanuardi Raharjo*

14.00-14.15	D-305	An analysis of e-commerce adoption for small and medium enterprises in Indonesia *Fauzan Fahruzzaman, Apol Pribadi Subriadi*
14.15-14.30	D-306	Braille Character Recognition Using Artificial Neural Network *Joko Subur, Tri Arief Sardjono, Ronny Mardiyanto*
14.30-14.45	D-307	Implementation of Navigation Target Seeker Mobile Robot Based on Pattern Recognition with Fuzzy Kohonen Network (FKN) Methods *Aditya P. P. Prasetyo, Katjuk Astrowulan, Ali Fatoni*
14.45-15.00	D-308	Performance Criteria Development of Medical Devices Maintenance Service Provider Approaching by Case Study Analysis *Primahasmi Dalulia, Moses Laksono Singgih*
15.00-15.30		Coffee Break and Pray
15.30-15.45	D-309	Parsing Indonesian Syntactic with Recursive Neural Network *Karisma Trinanda Putra, Djoko Purwanto, Ronny Mardiyanto*
15.45-16.00	D-310	The design of e-learning (share.its.ac.id) course "Sistem Pengendalian Otomatis" to Support Effective Learning Outcomes *Syamsul Arifin, Aulia Siti Aisjah, Nurlita Gamayanti,Tutug Dhanardono, Yaumar, Yusuf Bilfaqih*
16.00-16.15	D-311	Design Fuzzy Disturbance Observer With Neuro-Fuzzy Invers Model For Parallel Hybrid Electric Vehicle Speed Controller *Yoga Alif Kurnia Utama, Trihastuti Agustinah, Josaphat Pramudijanto*

Room E

Time	Code	Title and Authors
13.00-13.15	E-312	The Fusion of Smartphone Sensors for Indoor 3D Position and Orientation Estimation *Hani Ramadhan, Charles Lenay, Dominique Lenne*
13.15-13.30	E-313	Automatic Detection of Proliferative Diabetic Retinopathy With Hybrid Feature Extraction Based on Scale Space Analysis and Tracking *Wilda Imama Sabilla, Rully Soelaiman, Chastine Fatichah*
13.30-13.45	E-314	Prioritizing Usability Factors for Website Usability Improvement: A Case Study of Student Information System of Brawijaya University *Niken Hendrakusma Wardani, Apol Pribadi Subriadi*
13.45-14.00	E-315	Filmless Hospital with PACS as a Workflow Controller, Case Study: National Hospital Surabaya *Romeo, Febriliyan Samopa*
14.00-14.15	E-316	Solving Course Timetable Problem By Using Integer Linear Programming (Case Study IE Department of ITS) *Fakher Shwan Rafeek, Nurhadi Siswanto*
14.15-14.30	E-317	Signal Enhancement by Single Channel Source Separation *B. T. Atmaja, Dhany Arifianto*

14.30-14.45	E-318	A Hybrid Approach Support Vector Machine (SVM) – Neuro Fuzzy For Fast Data Classification *Elsen Ronando, M. Isa Irawan, Erna Apriliani*
14.45-15.00	E-319	Comparative Study on Data Mining Methods in Structural Reliability Prediction *Willy Husada, I-Tung Yang, Tri Joko Wahyu Adi*
15.00-15.30		Coffee Break and Pray
15.30-15.45	E-320	Distortion Inspection System Development of Rearview Mirror using Radial Line Method Based on Image Processing *Detak Yan Pratama, Apriani Kusumawardhani, Aulia M T Nasution, Andi Rahmadiansyah, Achmadi*
15.45-16.00	E-321	Indonesian Signaling Identification System Based on Hand Pose Gesture Recognition using Microsoft Kinect *Andi Rahmadiansah, Apriani Kusumawardhani, Heri Justiono, Detak Yan Pratama, Hendra Irawan*
16.00-16.15	E-322	Sliding Mode Control System of Single Phase Buck-Boost Inverter with Buffer Inductor *Purwadi Agus Darwito, Arief Abdurrakhman, Almas Fachrullah*

Room F

Time	Code	Title and Authors
13.00-13.15	F-401	The Design of Cement Distribution Network in Myanmar: A Case Study of Sin Minn Cement Industry *Aung Myo Lwin, I Nyoman Pujawan, I Ketut Gunarta*
13.15-13.30	F-402	Calculation Method To Analyze Concordance Between Supply and Demand of Bus Public Transport For Morning Commuter Trip At Gubeng Station *Jos Oktarina Pratiwi, Hitapriya Suprayitno*
13.30-13.45	F-403	Calculation Method for Assessing Connectivity Network Quality Case of Major Roads Padangsidimpuan City *Fithriyah Patriotika, Hitapriya Suprayitno*
13.45-14.00	F-404	Managing Risk of Lean Manufacturing Concept Implementation Approaching by Delphi and HOR *Wiwin Widiasih, Putu Dana Karningsih, Udisubakti Ciptomulyono*
14.00-14.15	F-405	The Significant of Cobit Mapping Business Goal 12 and IT Goal 19 (Case Study: Stikom Surabaya) *Siti Mukaromah, Apol Pribadi Subriadi*
14.15-14.30	F-406	Framework For Implementing Design Build Project Delivery System In Indonesian Road Infrastructure Projects (Cases Study : Balai Besar Pelaksanaan Jalan Nasional V) *Asri Maharani, Hitapriya Suprayitno, Herry Budianto*
14.30-14.45	F-407	Business Process Anomali Detection using Multi-Level Class Association Rule Learning *Fernandes Sinaga, Riyanarto Sarno*

14.45-15.00	F-408	Performance Improvement of Business Process Similarity Calculation using Word Sense Disambiguation *Endang Wahyu Pamungkas, Riyanarto Sarno, Abdul Munif*
15.00-15.30		Coffee Break and Pray
15.30-15.45	F-409	Quality Control Labelstock Types Z Using Residual Control Chart Based on Autoregressive Moving Average Model *Luh Made Pramitasari, Moses Laksono Singgih*
15.45-16.00	F-410	The Influence of Product and Facade Design towards Its Selling Price *Imanuel Mbake, Christiono Utomo, Purwanita Setijanti*
16.00-16.15	F-411	The Market Opportunities of Hotel Investment in Semarang *Nadiar Pratiwi, Christiono Utomo, Purwanita Setijanti*

Room G

Time	Code	Title and Authors
13.00-13.15	G-501	Computational Fluid Dynamics Analysis Into The Improvement Of Seakeeping Characteristics Of A Fast Craft Using Axe-Bow *Romadhoni, IKAP Utama, Binbin LI*
13.15-13.30	G-502	Analysis of Spatial Characteristic of Maritime Weather in Java Sea Water *Rachmad Andri Atmoko, Aulia Siti Aisjah, Gunawan Nugroho*
13.30-13.45	G-503	Vessel Collision Avoidance System (VCAS) Based on AIS Data *Arinta Y. Wardani, A.A. Masroeri, Aulia S. Aisjah*
13.45-14.00	G-504	Design of Tracking System and Disturbance Rejection Using Neural Networks for Autonomous Underwater Vehicle *Abdul Muis Prasetia, Trihastuti Agustinah, Joko Susila*
14.00-14.15	G-505	Study Of Ship Damage Collision In Order To Determine Width Of Double Skin Based On Width Of Penetration *Teguh Putranto, Wasis Dwi Aryawan, Achmad Zubaydi*
14.15-14.30	G-506	Prediction of Wave Height in Sumatera-Java Waters Using Backpropagation Neural Network *Illa Rizianiza, Aulia Siti Aisjah*
14.30-14.45	G-507	Analysis of the dynamic stability positioning control system of semisubmersible *Aulia Siti Aisjah, Eko Budi Djatmiko, Riza Aris Hikmadiyar, Nur Kholis*
14.45-15.00	G-601	Acoustic Performance of Live Music Café as Broadcasting Studio Concept at Shop Houses in Surabaya *Prilya Lutvitania Pradita, Ima Defiana, Wiratno Argo Asmoro*
15.00-15.30		Coffee Break and Pray
15.30-15.45	G-602	HAZOP Study Based ANFIS Layer of Protection Analysis On Unit Kiln PT. Semen Indonesia Factory Tuban *Henry Prasetyo, Ali Musyafa*
15.45-16.00	G-603	Design and Implementation of Adaptive Proportional-Integral-Derivative

		(PID) Controller for Speed Control Three Phase Induction Motor *Halim Mudia, Rusdhianto Efendi, Eka Iskandar*

Room H

Time	Code	Title and Authors
13.00-13.15	H-605	Effects of Acetic Anhydride toward Degree of Substitution on Acetylation Method of Sago Starch (Metroxylon sp) from Papua *Yuliya Andriani Nanggewa, Adi Setyo Purnomo, Surya Rosa Putra*
13.15-13.30	H-606	Study Interpretation Phenomenon Vibration Magneto-Mechanical Fesi Sheets for Magnetic Transformer *Mukhamad Aziz, Vincent Lanfranchi, Nicolas Buiron*
13.30-13.45	H-607	Effect of Hydrothermal extraction operation condition toward phenolic compounds content and aantioxidant efficiency of mangosteen (Garcinia mangostana) pericarp *Qifni Yasa' Ash Shiddiqi, Siti Machmudah, Sugeng Winardi*
13.45-14.00	H-608	Biomaker of Triasic Coal of Seram Island, Maluku Province *Jein Jelsi Lamia, R.Y. Perry Burhan*
14.00-14.15	H-609	Numerical Analysis on the Effect of Boundary Condition of Corrugated Plate under Blast Load *Raditya Danu Riyanto, Handayanu, Rudi Waluyo Prastianto*
14.15-14.30	H-610	Effect of phospotungstic acid toward composite membrane for DMFC application *Sri Endang Suharini, Dian Permana, Lukman Atmaja*
14.30-14.45	H-611	Effect of Calcium Carbonate as Filler at the Chitosan/CaCO3 Composite Membrane *Retno Rahayu Dinararum, Dian Permana, Lukman Atmaja*
14.45-15.00	H-612	ANTIOXIDANT ACTIVITY OF Mangifera indica L. LEAVES *Fitria, Sri Fatmawati, Taslim Ersam*
15.00-15.30		Coffee Break and Pray
15.30-15.45	H-613	Organic Geochemistry Study of Aliphatic Fraction of Bontang Coal, East Borneo *Titik Andriani, R. Y. Perry Burhan*
15.45-16.00	H-614	Temperature Measurement System Design Process On The Process Of Drying Madura Tobacco Leaves *Humadillah Kurniadi Wardana, Endarko*
16.00-16.15	H-615	Synthesis of Polymeric Membrane for Desalination Process *I Made Pendi Adi Merta, Deffry Danius Dwi Putra, Siti Nurkhamidah, Yeni Rahmawati, Fadlilatul Taufany*
16.15-16.30	H-616	Synthesis Of Nickel(Ni) Doped HKUST-1 Using Solvotermal Method With Addition Of Acetic Acid As Modulator *Farhan Fikri Safii, Ratna Ediati*

Room I

Time	Code	Title and Authors
13.00-13.15	I-617	Silica-Coated Mesoporous Carbon as Solid Dessicant in Gas Dehydration Process *Fadlilatul Taufany, Fahmi, Nurhamidah*
13.15-13.30	I-618	Parameter Estimated Gstarx Model With Gls Method *Andria Prima Ditago, Suhartono*
13.30-13.45	I-619	Work Function Modulation with Self-assembled Monolayers: Effect of Dipole Moment on Packing Density *Nia Nurfitria, Yu-Tai Tao, Ding-Chi Huang*
13.45-14.00	I-620	Conceptual Model Cognitive, Affective, Physical, and External Factor For Individual Information Technology Acceptance *Anfazul F. Azizah , Tony Dwi Susanto*
14.00-14.15	I-621	Simulation of Generalized Space-Time Autoregressive With Exogenous Variables Model With Variable of Type Metric *Reza Mubarak, Suhartono*
14.15-14.30	I-622	Technology Acceptance Model (TAM) Evaluation for Academic Information System (case study : Ma Chung University *Soetam Rizky Wicaksono, Audrey Amelia*
14.30-14.45	I-623	Interfacial Properties and Foamability of Amphiphilic Molecules *Stella Widyaningtyas, Audrey Drelich, Isabelle Pezron*
14.45-15.00	I-624	Study of Morphology of Reduced Graphene Oxide from Coconut Shell *Kusuma Wardhani Mas'udah, I Made Ananta Nugraha, Saiful Abidin, Fahmi Astuti, Darminto*
15.00-15.30		Coffee Break and Pray
15.30-15.45	I-625	Ternary Vapor-Liquid Equilibria for Alcohols + Glycerol + Water Systems to Enhance the Quality of Glycerol as Biodiesel Side Product *Eviana D. Setiawati, Asalil Mustain, Gede Wibawa*
15.45-16.00	I-626	Energy profile of faster-than-light particles : a new approach to the special theory of relativity *Matradji, Tutug Dhanardono, Heri Justiono*
16.00-16.15	I-627	Fault Diagnosis of Rotating Machinery based on Acoustic Emission using PARAFAC-Source Separation *Anindita Adikaputri Vinaya, Dhany Arifianto*
16.15-16.30	I-628	Vibration Effect on the SMS Fiber Structure *Ika Puspita, Ayu Kusumawardhani, Sekartedjo, A. M. Hatta*

Room J

Time	Code	Title and Authors
13.00-13.15	J-629	Study of The Correlation Between Contact Angle Values with The Polarity of Liquids

		Muhammad Alwi Syahara, Fredy Kurniawan, Wahyu Anggriawan
13.15-13.30	J-630	Design of Model Predictive Torque Control (MPTC) for Speed Control 3 Phase Induction Motor with Robust Stator Flux Observer *Halim Mudia, Mochammad Rameli, Rusdhianto Efendi*
13.30-13.45	J-631	Test Performance of Double Crosses Membrane Contactor for Simultaneous Absorption-Desorption Of CO2 Using Diethanolamine *Yeni Rahmawati, Toto Iswanto, Muhammad Rifa'i*
13.45-14.00	J-632	Effect of Sodium Hidroksida (NaOH) in Bitumen Separation Process from Asbuton in Hot Water *Afan Hamzah, Dita Ahmeta Ferdiansyah, Siti Nurkhamidah, Susianto*
14.00-14.15	J-633	Preparation and Cytotoxicity of 4-Allyl-2-methoxyphenyl propionate *Lingga Kamadatu, Mardi Santoso*
14.15-14.30	J-634	Microbend in an SMS Fiber Structure *Fitri Rahmah, Sekartedjo, Agus Muhamad Hatta*
14.30-14.45	J-635	Aromatic hydrocarbons of Wondama coal, Papua Barat *Christoffel S. I. Maweikere, R. Y. Perry Burhan*
14.45-15.00	J-636	Effect Of Glutaraldehyde Concentration Variation Toward Properties And Performance Of Composite Membrane (Chi-Mmt) For Dmfc Application *Sudir Umar, Dian Permana, Lukman Atmaja*
15.00-15.30		Coffee Break and Pray
15.30-15.45	J-637	Photochemistry in CuInS2 Quantum Dots/Polyoxometalate System *Azzah Dyah Pramata, Tetsuya Kida*
15.45-16.00	J-638	Surface Functionalization of Upconversion Nanoparticle for Biological Usage *Devi Wahyuningtyas, Hsien-Ming Lee, Hua-De Gao*
16.00-16.15	J-639	Prediction of Ceramic's Mechanical Properties Based on Sintering Temperature Using Neural Network *Zulkifli, Detak Yan Pratama, Dyah Sawitri, Purwadi Agus Darwito*

Potential of e-Learning for Enhancing Graduate and Undergraduate Education

Tsuyoshi Usagawa[1], Kohichi Ogata[1]

Abstract – Many educational institutes as well as governments focus on education utilize Information Communication Technology (ICT), and the word "e-Learning" is used in various contexts. There are many attractive aspects in e-Learning such as possibility to reduce the restriction due to spacial and temporal distance, possibility to improve the quality of education, and possibility to share educational resources among institutions. It is obvious to reduce the restriction by means of ICT such as mobile network. Also when a course is designed, the achievement level needs to be defined to satisfy the expected level of curriculum such as the diploma policy. In such a design process, it is possible to improve and sustain the achievement level of the course. In this paper, the principle motivation to utilize campus-wide e-Learning in Kumamoto University is explained as the background, then example courses of undergraduate and graduate programs are detailed to discuss the potential of e- Learning for enhancing education.

Index Terms – e-Learning, Blended Learning, On-line tests, undergraduate and graduate course.

INTRODUCTION

The nationwide Internet service for Japanese universities, named Science Information Network (SINET) [1], was established in 1992 by National Institute of Information (NII) [2].SINET has expanded year by year and SINET4 which started in 2011 has 8 core and 45 edge data-centres. Through those centres, most national universities are connected to SINET at least 2.4Gbps while backbone between Sapporo and Fukuoka is 40Gbps. As the expansion of SINET, the education on IT literacy became more and more important not only as technological issue but also legal and moral issue. In Kumamoto University, which has about 1800 fresh students every year, the education for IT literacy began before 1990, the SINET era, at some department in Faculty of Engineering, and spreads for all faculties in the middle of 1990's. Although the necessity of lecture was understood, there were several difficulties to deliver the lecture;

- Topics to be lectured are interdisciplinary; from technical issue to legal and moral issue
- Available lectures are very limited because of newer topics
- Facilities for education are not so well organized

In order to overcome those difficulties, Kumamoto University made continuous efforts over one decade. In this paper, we will discuss the some extend of detail of IT literacy courses for all fresh students across the disciplines; Education, Letter, Low, Medicine, Pharmacy, Science and Engineering. Since 2002, those courses have been delivered as blended-Learning Style; regular face-to- face meeting once a week, and homework on e-Learning system.

The effectiveness of the blended-learning style was widely understood in Kumamoto University through the IT literacy education, the board of university intensively promoted the e-Learning since 2004, and many lecture courses in various Faculties are transferred from conventional face-to-face only lecture style to blended learning style since then. One of examples is the "Digital Signal Processing I" (DSP-I hereafter) which is compulsory course in the fourth semester, fall semester of sophomore. There are two parallel classes to accommodate around 100 students for each. Authors deliver this course using the same e-Learning contents in blended learning style and evaluate the same crediting criteria using the same midterm and final examination.

For graduate courses, basic design concept of course is not the same for undergraduate course due to various aspects; number of students, elective courses, and focusing the communication skill as well as knowledge improvement. Typical seminar type course can be implemented on e-Learning system.

This paper shows two different type courses, an undergraduate level compulsory course and graduate level elective course in Kumamoto University from design concept as well as some outcomes. Also related activities including data mining of students' activities on the e- Learning system is also discussed.

MATERIAL AND METHOD

A. Campus-wide Learning Management System

In 1999, the first web-based School Information System (SIS) among Japanese national universities started its campus-wide services in Kumamoto University; syllabus registration by lecturers, course registration by students, credits registration by lectures, as well as reviewing the credits both by lecturers and students.

In 2002, the university start campus-wide e-Learning using a commercial Learning Management System (LMS), WebCT(RT). Students registration of LMS of all courses are synchronized with SIS as a daily batch process, thus any of lecturers can use e-Learning system without account management [3]. This account synchronization service lets lecturers to concentrate the contents developments and teaching processes. Currently there are more than 500 courses with "rich contents," i.e. not only static contents.

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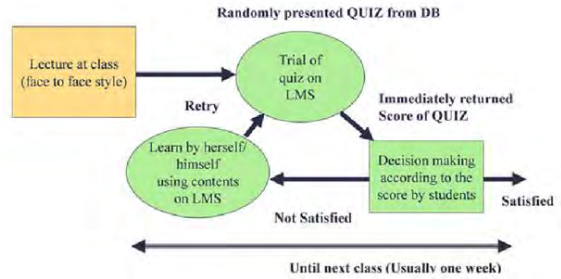

Figure. 1. Diagram of Chain of "Learn and Check" used in Quiz on LMS.

but also assessments, discussion, and other activities by students and interaction between lectures and students. Also out of 6000, around 1000 courses at least use LMS in some extend.

Since 2012, we started to shift the campus-wide LMS from WebCT to Moodle [4], and are planning to finish dual operation within a fiscal year of 2014. Among several reasons to change LMS from WebCT to Moodle, the most important one is the characteristics of open source which provide capability to develop additional modules to expand its function.

Based on those background, we decided to develop an original attendance management system as the add-on module for Moodle.

B. Experiences on IT-Literacy Courses for whole campus since 2004

When the concept of "IT literacy" course was designed, the analogy of driver's license is used. In order to get the driver's license in Japan, we need to pass the examination which consists of three category criteria; [A] driving skill, [B] knowledge of road traffic law, and [C] first-aid for traffic accident. Almost all who wish to get the driver's license can pass those examinations after sufficient practice; some may pass them right after practice, but some may take examination several times until they pass. From those point of view, Kumamoto University provides two compulsory courses for all 1800 fresh students across the disciplines. Those courses were designed based on the Instructional Design concept and use the blended-learning style with very rich quizzes and assessments.

Sets of online quizzes provide students with chance to confirm their understanding of the topics mentioned in the context at assigned week. Those sets are randomly generated from database by random selection of quizzes sufficiently large volume database of quizzes. Because of those treatments, students can try quiz as many times as they want until the specified deadline, which is usually set to the date of the next class, in other word, until next class. Figure 1 shows schematic diagram to show the process face-to-face lecture and online quiz. Students take a lecture by face-to-face style at class room. Students can try quiz as many times as they want, in other words, until they satisfied. When a student submit the answer of quiz, LMS system immediately feedback her/his rank in 1800 students as well as the score of submitted answer. Students are told a priori that the highest score of trials before deadline will be counted for the final evaluation. There is "loop" of trial of quiz, decision by student, and relearn about the online content, as shown in Figure 1. This loop is named as "Chain of Learn and Confirmation" [5].

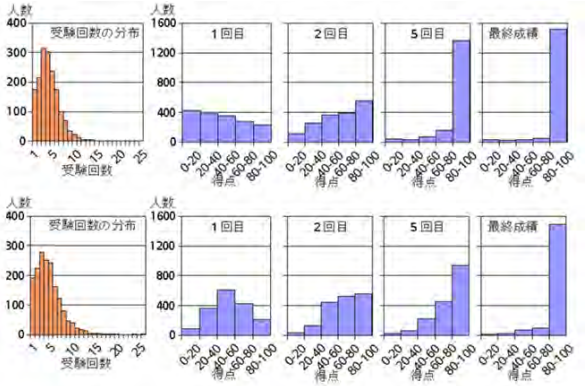

Figure. 2. Two examples of results of quiz. From left to right, distribution of number of trials, distribution of scores (highest one for each individual) at 1st, 2nd, 5th and last trial. Ordinate shows the number of students. Note that the total number of students is around 1800.

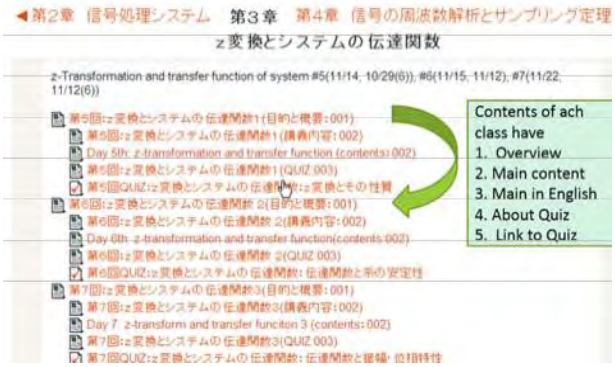

Figure. 3. Details of Chapter 2: Day 2-3 of DSP-I

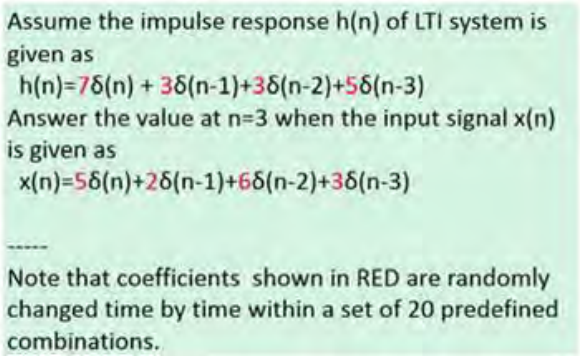

Figure. 4. Example of Quiz: Calculation type. Red numbers are randomly changed according the setting.

Figure. 5. Record of students' activities. Because the highest score within 5 trials are recorded, most of students try until they reach 100 or exceed the maximum trial times.

Figure 2 shows the two examples of results of quiz. Upper and lower graphs are corresponding to the two examples. In each row, from the left to right, frequency distribution of number of trials, score distributions at the 1st, 2nd, 5th trials and at last. All of

ordinates show the number of students. Abscissa of left most graph is the number of trials. And abscissas of other graphs are scores of quiz where 100 is the top score. As shown in those examples, even if the initial distributions of score are varied, the final distributions are very similar; more than 90% of students made score equal or higher than 80. This tendency of score distributions is very similar for all sets of quiz. These data provide the assurance of learned level of students by quiz.

C. New organizations for e-Learning

Although the design of IT literacy course is stimulated by Instruction Design, it was necessary to make organizational activities to spread this movements. In 2006, we have established the first graduate school for e- Learning professional in Japan, namely Graduate School of Instructional System (GSIS) [4], then the Institute of e-Learning Promotion (IELD) in 2007[5]. Both of them promote e-Learning for all faculties especially in Faculty of Engineering and Medical School beside GSIS itself since then

COURSE DESIGN

The design of IT literacy course seems to provide very strong tool for undergraduate fundamental courses because the expected knowledge level of most of students are very similar as the graduate of high schools. Thus ”Learn and Check” concept as shown in Fig.1 is accepted as the effective way.

For graduate school students, a prior knowledge and experiences of each student may not be the same. Thus a course for graduate school is designed for intensive discussion and the background knowledge is examined first then necessary contents are supplied only for the students who need to review. This ”Check first” concept is basically similar to TOTE (Test Operation Test Exit) model proposed by G A. Miller [6].

DETAILS OF TWO COURSES

A. Compulsory Course for Sephomore

Authors have started to deliver the course “DSP-I (Digital Signal Processing I)” by blended learning style using WebCT since 2007[7]. DSP- I is delivered in two classes, each of which has about 90-100 students.

The same syllabus, the same weekly contents with assessments, the same final examination, and the same evaluation criteria.

The same text book and the contents with various links and multimedia contents.

Since 2013, the course is delivered on Moodle, Open Source LMS.

Figure 4 shows an example of calculation type quiz. Students are allowed to try each quiz session up to 5 times, but most of students can reach the 100% of source within 3 times as shown in Figure 5. This means at least once student was able to answer the quiz perfectly before moving to the next topics.

The results of grading of class A and B for DSP-I were almost the same. Also the anonymous questionnaire taken at the last lecture day but before the final examination show the similar comments among in 2007, 2008, and 2009; more than 90% students evaluate the teaching material is effective, and almost 80% studied more than an hour per week. As the total, 85.5% students said the course as meaningful. Note that some of failed students said the course was meaningful. As the lecturers, authors wish to reduce the failure ratio so that there are many thing to do to encourage to study as well as to support necessary assistance using face-to-face session and e-Learning contents.

Figure. 6. Top page of “Multi-dimensional Signal Processing” with 3 tasks to complete this course.

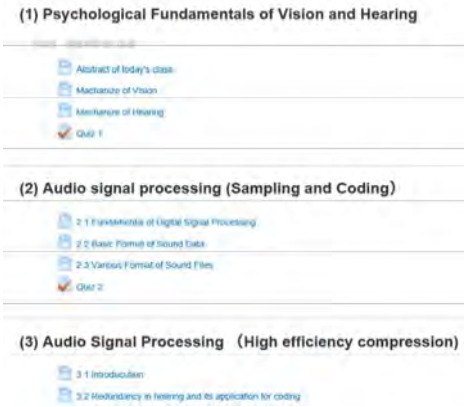

Figure. 7. Contents for Task 1. Each section consists of learning contents and quiz to assess the understanding. Although students can learn contents first, but they are recommended to take a quiz first then learn.

B. Elective Course for Master Degree Student

This course discusses the multi-dimensional and multi- module signal processing, and it is designed as 2 credits course delivered in English. In the top page of the course, students are asked to works on three tasks as shown in Figure 6.

Because the expected level of students’ knowledge to the topics discussed in the course, the lecturer encourages students to take a quiz first, then return to the contents. This scheme seems to be the similar to “Learn and Check” shown in Figure 1, but there are no face-to-face lecturing at a class room. Thus students may learn the contents first, then check their understandings by quiz, but they may learn the contents after they find out the weakness by taking the corresponding quiz. There are necessary level to exceed in quiz session, i.e. more than 60% for every quiz session. Before moving to Task 2, all students must understand the course contents at least to get 60% of score in quiz.

Task 2-3 is designed to let all students make presentations and the evaluation will be made both by other students as well as lecturer. Portion of this presentation is 50% while the Task 1 corresponds to 40%. Last 10% is assigned to the final short report.

DISCUSSION - EXAMPLES OF OTHER INSTITUTES

Sary et al. implement the blended learning course at the Faculty of Engineering, the University of Sam Ratulangi (UNSRAT), Manado, Indonesia [9]. And they also reported the lecturers and students' readiness of e- Learning at UNSRAT, and concluded both have interests and desire to use e-Learning [10]. N. Jachin et al. implemented the blended-learning courses in Gurvan- Erdene Teacher's college (GETC), Ulaanbaatar, Mongolia. Although the students are not so familiar with ICT, they were quite positive to blended-learning style of lecturers [11]. Prasad et al. focused on the possibility of Open Textbooks and Open Educational Resources (OER), and made baseline survey of lecturers at the University of the South Pacific (USP) [12]. They concluded the lecturers in USP have willing to develop OER derived custom-built open textbooks to increase the affordability of the textbook.

CONCLUSION

This paper shows the potential of e-Learning for undergraduate and graduate level education as well as discusses the examples of blended learning in various institutes in Indonesia and Mongolia.

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REFERENCES

[1] http://www.sinet.ad.jp/english/

[2] http://www.nii.ac.jp/

[3] T. Usagawa, K. Sugitani, T. Kita, N. Iriguchi, M. Migita, R. Matsuba, H Nakano, "Assuring the basic IT literacy levels for every student by the University-wide blended learning," Proc. 7th Int'l Conf. on Inform. Tech. Based Higher Edu. & Training (ITHET), No.258 (CDROM), pp.1-5 (2006)

[4] http://www.moodle.org/

[5] http://www.gsis.kumamoto-u.ac.jp

[6] http://www.ield.kumamoto-u.ac.jp

[7] http://www.mindacademy.com/nlp/tote-model

[8] T. Usagawa, K. Ogata, "Signal Processing Education Facilitated by Blended Learning - Potential of E-Learning Combined with Face- To-Face Lecture -," Proc. YKJCA 2013, Busan (2013)

[9] P. Sary, Y. Chisaki,, T. Usagawa, "Development and Evaluation of the Blended Learning Courses at Sam Ratulangi University in Indonesia.," International Journal of e-Education, e-Business, e- Management and e-Learning vol. 2, no. 3, pp. 242-246, 2012.

[10] P. Sary, Y. Chisaki, T. Usagawa, "Assessing Lecturers and Student's Readiness for E-Learning: A preliminary study at National University in North Sulawesi Indonesia," GSTF Journal on Education (JEd), Vol.2, No.2, pp.1-8 (2015), DOI: 10.5176/2345-7163_2.2.50

[11] N. Jachin, Y. Chisaki, T. Usagawa, "On Students' Experiences and Performances in Pilot Blended Learning Class, a Teacher's College Mongolia," Proc. International Symposium on Information Science and Information Management (IS& IM) 2013,

[12] Paper #2004, Nov. 6-8, Bangkok, Thailand

[13] D. Prasad, T. Usagawa, "Towards Development of OER Derived Custom-Built Open Textbooks: A Baseline Survey of University Teachers at the University of the South Pacific," The International Review of Research in Open and Distance Learning, Vol. 15, No.4, pp.226-247, Sep. 2014.

Science and Technology of Light: Recent Developments and Future Directions

Azzedine Boudrioua[1]

These last decades, optical telecommunications have made a spectacular success thanks to the explosion of Internet. This development is the fruit of a main effort of research and development in the field of guided optics which led to the improvement of the performances of optical fibers and optoelectronic components able to generate, detect, modulate or commutate light. Consequently, optoelectronic components of any kind at low cost become available in the market pushing the emergence of other applications in various fields.

As a matter of fact, today the use of optics includes strategic fields like space and military ones and also fields of everyday life like data storage (CD and DVD), medicine and unsuspected sectors such as car industry. In a competing way, the advent of Nano-Photonics is pushing the limits of photonic devices miniaturization on scales lower than the wavelength.

The interest of using the photon rather than the electron comes from the very high optical frequencies of the optical signal which allow a very broad band-width and offer an unequalled data transmission capacity. Ultimately, the 20th century was the century of electronics and the 21st century is expected to be that of photonics.

This presentation will give a highlight of the main concepts and the recent development of photonics technology as well as future challanges.

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Research Opportunities in Japanese Universities and Tips for Scientific Publications

Siti Machmudah[1]

Abstract – This article gives information for researcher to do research in Japanese Universities based on author's experience and some literatures. Researchers may obtain research opportunities with Japanese Universities through postdoctoral fellowship program provided by Japanese Society for the Promotion of Science (JSPS). Other financial supports to make research collaboration with Japanese Universities may also be applied through JSPS program. In addition, author summarized tips for scientific publications both in international conferences and journals. The tips may help researchers to write a scientific article to be published in an international journal.

Keywords – Research Collaboration; JSPS; Scientific Article; International Journal.

INTRODUCTION

In order to support ITS for realizing its vision as a world-class university with international recognition in science, technology and art, building international cooperative network is very important. It can be implemented in promoting joint research with internationally recognized universities and supporting researchers to participate in a research community. Promoting joint research with internationally recognized universities can be initiated by supporting young researchers to join postdoctoral fellowship offered by scientific foundation/organization in the world. Japan is one of the top science countries in the world who offer some programs to support foreign researchers in the world to do research in Japan.

Minister of Education, Culture, Sports, Science and Technology (MEXT), Japan, H. Shimomura, wrote that Japan welcomes creative researchers from around the world, and many opportunities are open to us for enjoying science life in Japan [1]. MEXT offers many opportunities to conduct joint research with Japanese researchers as postdoctoral fellowship as well as academic staff. To implement these activities, in 2007 MEXT designates 9 centers to create open research platforms that attract the world's best brain with English as primary operational language. Research opportunities and institutions who support research activity in Japan will be discuss in the next section.

Scientific publications are a wide spread form of scientific and technological communication used by agents of the national innovation system to deliver codified and replicable results of scientific experiments, methodologies and conceptual contributions. Publications are usually related to fundamental research but sometimes can also contain applied information and evidence of individual technologies, algorithms, methods, and processes that may immediately be used in industry, and in the wider economy and social life [2]. Researchers' publication records are the main indicator used in career progression decisions and for measuring the excellence of research performing organizations, especially in settings where basic research predominates. Therefore, scientific publication from researchers or academic staffs is very important for ITS as a tool to be a world-class university.

In this article, authors would like to share the information of research opportunities in Japan and summarize the tips for scientific publications, especially for publication both in international conferences and journals.

RESEARCH OPPORTUNITIES IN JAPAN

Author emphasizes research in Japan because Japan is one of the top science countries in the world. It can be noticed that Japan is 2nd country in the world for number of Nobel Prize winners (2001-2012) and number of papers (2004-2006) [1]. Moreover, universities in Japan are the places that advance and encourage international culture and engagement, which result in many synergistic activities in a wide variety of research fields. Laboratories in Japan are some of the best -maintained, -equipped, and -funded laboratories in the world. New research initiatives on key and future concepts have been characterized by longevity of funding. Furthermore, researchers can develop their ideas in accordance with the research concepts that have been defined.

MEXT offers many research opportunities in Japan for researchers around the world. Some programs have been launched by Japanese Society for the Promotion of Science (JSPS). JSPS was established with an imperial endowment in 1932. JSPS was converted into a quasi-government organization in 1967, and into an independent administrative institution in 2003. JSPS's program rests on four pillars: (1) Creating world-class knowledge in diverse fields; (2) Building robust international cooperative networks; (3) Fostering the next generations of researchers and enhancing the education and research functions of universities; and (4) Building evidence-based science-promotion systems while strengthening linkage with society. Based on them, JSPS advances scientific research through its Grants-in-Aid for Scientific Research and other funding programs; fosters young researchers through its Research Fellowships for Young Researchers and other researcher development programs, promotes international scientific exchange, and supports university reform and globalization. JSPS's budget is 99.8% subsidized by the Japanese government. JSPS's budget for the 2014 fiscal year totals ¥301.2 billion. This amount is divided into

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direct funding of ¥259.8 billion and indirect funding of ¥41.6 billion. The indirect funds are provided in MEXT's budget for program selection and assessment functions performed by JSPS [3]. JSPS's budget transition from 2009 to 2014 with the breakdown of the main items of the budget is shown in Figure 1.

JSPS offers fellowship programs to give opportunities for excellent researchers from around the world to come to Japan to conduct scientific collaboration with their Japanese colleagues. The fellowship programs are applied to all fields of research including the humanities, social sciences, and natural sciences. These programs are addressed to a full spectrum of researchers from young researchers to eminent scientists. The duration of research is flexible from short to long terms. These programs are available to all universities and research institutions in Japan. The fellowship programs are classified into 2 programs: (1) JSPS Postdoctoral Fellowships for Overseas Researchers, and (2) JSPS Invitation Fellowships for Research in Japan.

A. JSPS Postdoctoral Fellowships for Overseas Researcher.

1) Standard Postdoc

The purpose of this program is to provide opportunities for young postdoctoral researchers from overseas to conduct, under guidance of their host, cooperative research with leading research groups in Japanese universities and other institutions. Duration of research is 12 to 24 months, and approximate number of fellowships is 350 per year. This program is eligible for researchers who hold doctorate degree when the fellowship goes into effect, which must have been received within the past 6 years. Terms of award are including round-trip air ticket, overseas travel insurance, monthly maintenance allowance of ¥362,000, settling in allowance of ¥200,000, and Grant-In-Aid for JSPS Fellows of up to ¥1,500,000 per year. This program must be applied by a host researcher in Japan.

2) Pathway to University Positions in Japan

The purpose of this program is to promote the employment of overseas researchers in full-time position at Japanese university and research institutions. Duration of research is 12 to 24 months, and approximate number of fellowships is 20 per year. This program is eligible for researchers who hold doctorate degree when the fellowship goes into effect, which must have been received within the past 10 years, and hold a position as an associate professor or equivalent. Terms of award are including round-trip air ticket, overseas travel insurance, monthly maintenance allowance of ¥387,600, settling in allowance of ¥200,000, and Grant-In-Aid for JSPS Fellows of up to ¥1,500,000 per year. This program must be applied by a head of a university or a research institution in Japan.

B. JSPS Invitation Fellowships for Research in Japan

1) Long-term for Mid-career to Professor Level

This program allowed researchers employed at designated Japanese research institution to invite fellow researchers from other countries to Japan to participate in cooperative activities at their research institutions. Duration of research is 2 to 10 months, and approximate number of fellowships is 80 per year. This program is eligible for researchers who hold a full-time position in an overseas research institution, and hold a position equivalent to a university professor, associate professor or assistant professor in Japan. Terms of award are including round-trip air ticket, overseas travel insurance, monthly maintenance allowance of ¥369,000, domestic research trip allowance of ¥100,000, and research allowance of ¥40,000. This program must be applied by a host researcher in Japan.

2) Short-term for Professor and Associate Professor

This program allowed researchers employed at designated Japanese research institution to invite fellow researchers from other countries to Japan for short periods of time to participate in discussions, attend seminars, give lectures, or conduct similar activities at their institutions. Duration of research is 14 to 60 days, and approximate number of fellowships is 240 per year. This program is eligible for researchers who hold a full-time position in an overseas research institution, and hold a position equivalent to a university professor or associate professor in Japan. Terms of award are including round-trip air ticket, overseas travel insurance, daily maintenance allowance of ¥18,000 and domestic research trip allowance of ¥150,000. This program must be applied by a host researcher in Japan.

C. Short-term S for Nobel Prize Level

Under this program, overseas researchers who have eminent records of research achievements and awards on a Nobel Prize level and who are actively leaders in their field are invited to Japan to give lectures, guide research, and conduct other activities. Duration of research is 7 to 30 days. This program is eligible for researchers who are Nobel laureates or recipients of similarly high-level international prizes with exceptionally outstanding records of research achievements and who currently occupy a leading position in their subject field. Terms of award are including business-class round-trip air ticket, overseas travel insurance, daily maintenance allowance of ¥42,000 and domestic research trip allowance of ¥150,000. This program must be applied by a host researcher in Japan.

JSPS's programs also involve counterpart institutions in overseas. Directorate General of Higher Education, Ministry of Education and Culture (DGHE) and Indonesian Institute of Sciences (LIPI) are the overseas counterpart institutions of JSPS in Indonesia. Indonesian researchers are relatively active to participate on the JSPS program compared to other Southeast Asian countries. The number of researchers exchanged from Asian countries from 2011 to 2013 can be seen in Figure 2.

Fellowships for overseas researchers are also offered by public research institutes and universities in Japan through other schemes. Other public research institutes

and universities who offer the fellowships are as follow.

1) World Premier International Research Center Initiative (WPI)

The World Premier International Research Center Initiative (WPI) was launched in 2007 by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in a drive to build within Japan "globally visible" research centers that boast a very high research standard and outstanding research environment, sufficiently attractive to prompt frontline researchers from around the world to want to work in them. These centers are given a high degree of autonomy, allowing them to virtually revolutionize conventional modes of research operation and administration in Japan.

JSPS is commissioned by MEXT to conduct the program's grant selection and project assessment processes and to perform other administrative functions. The selected projects for WPI is summarized in Table 1 [4].

2) RIKEN

RIKEN is Japan's premier research organization for basic and applied research. Since its foundation in 1917, RIKEN has been building global networks and seeking global talent.

3) Tsukuba Science City

It is the largest cluster of science and technology city including about 30% of all national research institutes in Japan (e.g. NIMS). It is also beautiful cosmopolitan city with a lot of green.

4) JST (Japan Science and Technology Agency)

The Japan Science and Technology Agency (JST) is one of the core institutions responsible for the implementation of science and technology policy in Japan, including the government's Science and Technology Basic Plan. From knowledge creation -the wellspring of innovation- to ensuring that the fruits of research are shared with society and Japan's citizens, JST undertakes its mission in a comprehensive manner. JST also works to provide a sound infrastructure of science and technology information and raise awareness and understanding of science and technology-related issues in Japan [5].

5) Others

Other information of research opportunities in Japan can be obtained in Japan Research Career Information Network (JREC-IN) Portal [6]. JREC-IN Portal is an informative portal site that supports the career development and skills building of researchers, research assistants, technicians and other research-related human resources. This website contains a database of information on applicants searching for research jobs and job postings for research and education positions in industry, academia and the public sector. Both applicants and recruiting institutions can browse and search online for postings or individuals that meet their needs. This website also provides other contents and information about networking or other events organized by education or research institutions for the broad career development of researchers.

SCIENTIFIC PUBLICATIONS

Scientific publications contribute to the diffusion of new codified knowledge mostly to other researchers in the public sector research system but also to those working in firms and in government (policy and regulation). In addition, the process of working towards scientific publication – which demands novelty and quality – has considerable spillover effects on other activities and outcomes associated with public sector research, thereby contributing to innovation. While largely beneficial, too much emphasis on publication performance can lead to the generation of frivolous articles and sometimes to inappropriate behavior. Therefore, the extent to which regular performance evaluations are incorporated into public sector funding regimes will be a factor in shaping contributions to scientific publication output. Availability of funding, proper R&D infrastructures, knowledge networks and quality scientific skills are also important factors influencing the number and quality of scientific publications.

It has become a good practice to control the quality of scientific and publications through the peer review process, which usually involves two or more academic experts reviewing a given manuscript in a double-blind manner, where both reviewers and the author(s) cannot easily identify each other's names and hence can expect an objective evaluation and revision of an article to make it a genuine contribution to knowledge.

A. Writing Scientific Article

Being capable of publishing in peer-reviewed journals is commonly seen as an indicator of proper scientific research. It is the duty of a researcher to publish his results for the scientific community. Research can be seen as a product that must be sold to the target audience in the form of an article. In other words, research results do not exist before they are successfully published. The key people for getting one's article accepted for publication are the editor-in-chief, editor, and reviewers. After publication, a well-written article will attract readers, eventually resulting in a scientific impact defined by whether other scientists will cite the article.

Unfortunately, many researchers are far more comfortable conducting scientific experiments than they are reporting and publishing their findings. As a result, a considerable amount of research is not published in a way that adequately expresses its significance [7]. On the other hand, researchers who communicate well are successful in gaining recognition and support for themselves individually, but also for their institution [8]. These are among the motivations as to why it is vital to achieve proficiency in writing scientific journal articles. It is vital for a new researcher to start writing articles as soon as possible. An early start will speed up the learning process. When you are writing, you are forced to think about your substance from different perspectives.

The process of writing an article is initiated by considering the significance of the future article, its importance and potential newness to the scientific community. It is also vital to identify those who might

be interested in seeing your results, i.e. who is the target audience? In addition, it is beneficial to consider the practical implications of your research. A scientific article must be based on research that is conducted scientifically by using accepted methods. An article wraps up research by presenting it clearly and concisely to the scientific community.

The scientific article must answer the following basic questions:

- What is the problem that is addressed?
- Why is it important?
- How did you study the problem?
- What are your results?
- What are the implications of the results?
- What do you recommend as further study for others?

Articles are often written in small groups, which makes it possible to include the views of several people. Writing articles together with co-authors is a good way to obtain necessary feedback for your research. In addition, it is possible to have others to comment on your work, for example by offering favors in return. However, dynamic group work cannot afford freeloaders; everyone involved must have something to offer. Different types of capabilities and backgrounds can be a strength. Nevertheless, working for the same project does not mean your name will automatically appear among the authors of the article, as all the authors are required to provide a positive contribution to the realization of an article. Also, note that some journals limit the number of authors (e.g. four). As a rule of thumb, it is beneficial to include your supervisor as a co-author, if you are a doctoral student. This way you show respect and acknowledge the help you receive as well as maintain the work relationship.

It is beneficial to decide on a target journal during the very early stages of writing an article, rather than first preparing an article and then considering where to send it. Analyze potential journals and choose one. Write your article with your target journal in mind. This is useful because different journals have different perceptions of science as well as differing opinions on how articles ought to be written. By writing directly for your target journal, you will ensure the right type of approach and speed up your writing process. If you wish to be even wiser, you may also choose a secondary target journal for the case that your primary option fails.

Journal articles are commonly recognized above conference papers, even if many of the conference publications use peer review practices. It is recommended that a researcher, even at early stages, should start the learning process of writing for journals. Once experience is gained, one should raise his ambition level step-by-step and aim towards publishing in increasingly better journals. The impact factor is one way to measure the level of journals [9]. Note that this is not an absolute measure and there are differences among different fields of science. A researcher should see conferences as an additional medium for networking and as an avenue to obtain more face-to-face feedback. However, the ultimate goal should be eventually publishing the work in a journal. A researcher should consider his ambition level and assess the level of his own research when choosing the publication medium.

B. Recommended Order of Writing

According to author's experience the different elements of an article should not be written in the same order as the final layout of the article. The list below presents a recommended order of writing that is proven most efficient, avoiding unnecessary iterations.

1) Writing experimental elements
   - Results
   - Analysis
2) Research Process
3) Finalizing Theory
4) Introduction
5) Conclusions
6) Abstract
7) Title
8) Final revision

The order of writing presented here highlights the importance of our results for defining the focus of our article. We should define the focus of our article based on the evidence we have. This way we can set the focus of our article relatively early and avoid unnecessary re-working when writing up the theory and other elements of the text.

It is sensible to start writing an article by outlining the subject matter and content by a few bullet points or key words. This phase will act later as an aid in writing the introduction.

After outlining the initial ideas, we can try to find a suitable target journal. Once selecting a potential target journal, outline the initial theory for our article. After this, we will need to concentrate on the core: the "heart and soul" of our article and write the results and analysis of our research. Once we have these elements, it may be worth reviewing our target journal selection. If there are any reasons to change, pay attention to the potentially different format and other requirements, such as the recommended article length that our new target journal may have. Once we have the core substance ready, we can concentrate on elements critical for acceptance; the introduction, the discussion and the abstract.

Writing one's first journal article usually takes several months of intensive work, but later, through experience, the process will speed up significantly. Novice authors should especially bear in mind the importance of multiple iterations. Once we have written a paragraph, do not believe it is the final version. When we have written the other sections to our article, we will most likely have to return to this previously written paragraph, re-analyze its content, consider its place and even the justification for its very existence in the final article.

C. Tips for Writing Article Elements

An article typically constitutes the following sections and elements:

- Title
- Abstract
- Introduction

- Theory/Literature review
- Research method/ process
- Results (sometimes divided into results & analysis/discussion)
- Conclusions

There are a lot of writing guides available which provide advice on the structure of proposed articles. One example is the commonly known IMRAD (Introduction, Method, Results and Discussion) structure [10]. The terminology may differ somewhat, as for example in the IMRAD scheme the literature review is integrated into the Introduction section, however, the above list presents the literature review separately. Also, discussion, which D stands for in IMRAD, is the same as conclusions in the above list. Discussion in the above list covers the interpretation of the result by the researcher. This again slightly differs from the IMRAD model. To sum up, there is no commonly accepted right structure and terminology. The differences between journals are, however, marginal, once you have understood the essence of the key elements. The best solution for a researcher is to follow the structure and terminology of their target journal.

The following will provide tips for each individual section.

1) Title

When considering a title for an article, do familiarize yourself with the types of titles in the target journal, analyze whether they are more general or very specific. The editors-in-chief may want the article titles to sell and gain clicks. This is why in some cases a more general title is better than an overly specific one. Avoid abbreviations in the title as well as unnecessary "and" words. Fundamentally, a very long title is not good as the reader may have difficulties in perceiving the content. Again, there are some journal and field specific differences in the types of titles, and following the practices of the target journal is the best approach. The suitable title length depends on whether the target journal favors indicative or informative titles. Journals favoring short indicative titles may, for example prefer titles with less than eight words. On the other hand, other journals may prefer long informative titles. However, researchers ought to attempt simplifying their titles even when longer ones are allowed.

2) Abstract

The Abstract is one of the most central elements of our article, luring other people to read it and may also influence the acceptance of the article. An abstract must describe the purpose of the article. Moreover, it must describe how we have realized our research and provide few key findings and any practical implications. We can build our abstract by answering the following questions with one or two sentences for each one:

- What is the bigger, more general field the article relates to?
- What is the purpose of the article?
- What methodology did we use?
- What are the key results?
- What are the practical implications of the research (how can the results be utilized by e.g. practitioners, society or companies)?

The target journal may have some specific requirements related to formulating the abstract, such as word count. Should the target journal require a structured abstract, please follow their instructions. In addition to a conventional written abstract, some journals also use graphical abstracts, i.e. the authors include an illustration to accompany the text.

The Abstract is typically followed by key words. Follow the practices of the target journal when defining the key words.

3) Introduction

The Introduction justifies the significance of the subject matter and connects your work to previous research. This chapter can also include a definition of the key terms, if necessary. In reality it is better to use a limited number of terms and be consistent in their use. One rarely needs to invent completely new terms even when discussing something totally new. It is essential for the author to understand the true meaning of the terms used and be able to communicate them clearly.

Start the Introduction with sentences that are adequately general, and simple enough to understand even for those who are not experts in exactly the same topic as our article. This way different type of readers can position our article into previous research more easily. Aim to motivate the reader and help them understand why our research topic is important. Utilize published journal articles, preferably recent ones, to point out the importance of our research by highlighting how it relates to them. This will please editors who want the scientific discussion to occur in their own medium.

The research problem the article aims to address must be described at the end of the introduction. One recommended way to deepen the description is to use research questions or hypotheses. Research questions help the reader to perceive the content of our article and the author to structure his thoughts and writing. The reader may also use the research questions to reflect the reasoning while reading through the article. When using research questions, the author must remember that the questions can be changed or adjusted during the writing process. It is also imperative that the research questions and later results match in the final version of the article.

4) Theory/Literature Review

One can start writing the literature review by finding a few good articles, of which some are from the target journal, and maybe a few good books discussing our topic. Later on use these articles as a base and expand our literature review. Typically, finding one good article relevant to our research starts a chain reaction as some of the references in that article may also be relevant to your work. Write a summary of a few pages based on these articles and books. This will help in obtaining a relevant understanding of our research topic and will act later as a frame for the theoretical part of our article.

Write the theory to support the storyline of the article. Note that it is not customary to describe the

development of our own understanding in an article, but describe what others have studied that is relevant to our topic. The purpose of a literature review is not to present all possible references, but to concentrate on those that are relevant for the focus of our article. The literature review will position our research in relation to previous literature; therefore cite articles on which our research is based. Aim to depict the state of research relevant to our article before our study. We can reflect our results against the previous literature in the discussion section of our article. Minimize self-citations; only cite our own previous work if absolutely necessary.

It is wise to finalize the theory only after writing up the results of the article. This way we can once more search for related studies and can thus better focus the literature review to match our results.

5) Research Method/Process

The article must describe our research, the set-up and research methods precisely. This way the reviewers can assess the scientific basis of our research and the justification of our results. In principle, the research method/process should be described so that another researcher can repeat the study. We must prove that the methodology we have chosen is robust and applicable for our study. Should we use research methods that are established in our field, it is enough to cite the methods and there is no need to describe these aspects in detail.

6) Result and Discussion

Having completed the experimental research and having analyzed the results, it is time to write up and summarize the results as well as the analysis. The experimental section of a journal article must concentrate on the actual analysis of the material, not on documenting the data. Note that this differs from writing for other purposes, such as writing a research report.

Consider what the key results of our research are and present them clearly. Build the Results section of our article around these key results. Present the results in such an order that their logic is as easy for an outsider to understand as possible. Should we not have any better way to decide the order of presentation, use the funnel principle; from more general to more specific points. Remember to highlight the key results by using visual elements, such as lists, illustrations/figures and tables. This way, anyone who quickly riffles through the article will focus on the key results and will automatically get a level of conception of the results.

We may include a Discussion section at the end of the results section to explain and contemplate the results. The discussion can either be a part of the Results section or a separate section of its own, whichever is in line with the practices of the target journal. Please note that the reader must be able to separate easily the research facts from the researcher's own thinking.

7) Conclusions

The Conclusions section, alongside the Abstract and Introduction, is one of the core elements of a journal article. The Conclusions section can be written up by using the following structure (one paragraph each):

- Introduction
- Results (one paragraph for each research question)
- Significance of the research/practical implications, for example for the society, or business companies
- Limitations
- Recommended topics for further study

The Conclusions must be in line with the previous sections and should not present totally new results. The implications should, however, be discussed

CONCLUSION

Research collaboration and scientific publications from researchers are very important for universities or research institutions as a tool to be a world-class university/institution. This article gives information on the research opportunities in Japan and summarized tips for writing a scientific article to be published in international journal.

REFERENCES

[1] Noname. (2015, July 13). *Research in Japan*. Available: http://www.mext.go.jp/researchinjapan.

[2] Noname. (2015, July 14). *Scientific Publication*. Available: http://www.innovationpolicyplatform.org/content/scientific-publications.

[3] JSPS, JSPS 2014-2015, 2015, pp. 1-3.

[4] Noname. (2015, July 15). *WPI*. Available: http://www.jsps.go.jp/wpi.

[5] Noname. (2015, July 15). *Japan Science and Technology Agency*. Available: http://www.jst.go.jp/EN/about/index.html.

[6] Noname. (2015, July 2015). Available: https://jrecin.jst.go.jp/seek/SeekTop?ln=1

[7] T. Spector, "Writing a Scientific Manuscript: Highlights for Success", J. Chem. Educat., vol. 71, pp. 47-50, Dec. 1994.

[8] L.D. Yore, B.M. Hand and M.K. Florence, "Scientists' views of science, models of writing, and science writing practices", J. Res. Sci. Teach., vol. 41, pp. 338-369, March 2004.

[9] B.M. Althouse, J.D. West, C.T. Bergstrom and T. Bergstrom, "Differences in impact factor across fields and over time", J. Am. Soc. Inform. Sci. Technol., vol. 60, pp. 27–34, Sep. 2008.

[10] D. Sharp, "Kipling's Guide to Writing a Scientific Paper", Croatian Med. J., vol. 43, pp. 262-267, Feb. 2002.

Utilization of Local Materials in Green Concrete Technology

Ridho Bayuaji[1]

Sustainable development is a concept in green building, which involves ecological, social and economic objectives. It requires to sustain the integrity of resources exploitation, the orientation of technological development and the direction of investments. Concrete is most used construction material worldwide. However, the concrete also brings a great environmental cost. The billions of tons of natural materials mined and processed every year and huge enormous amounts of energy required to produce the cement as well as 7-8% of CO2 released into the atmosphere in the cement processing.

This paper discusses the various efforts to improve the concrete environmental friendliness or as a green building material. The most potential successful effort in this matter is utilize local substitutes for cement, especially those that are byproducts of industrial processes, like fly ash, ground granulated blast furnace slag and silica fume.

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An Overview of *Ganoderma lingzhi* Constituents on α-Glucosidase and Aldose Reductase Inhibitory Activity

Sri Fatmawati[1]

Ganoderma lingzhi is the medicinal woody mushroom which have been known to have hundreds bioactive compounds. The lanostane-type triterpenoids with carboxyl group in the side chain or known as ganoderma acids were isolated from the fruiting body of *G. lingzhi*. Some of these compounds were established as active inhibitors of α-glucosidase and human recombinant aldose reductase *in vitro*. The research objective is to enlighten the role of structural requirement of ganoderma acids both for α-glucosidase and aldose reductase inhibition.

Comparing the inhibitory activity of these two enzymes, the structure–activity studies of ganoderma acids showed that the hydroxyl substituent at C-11 and the carboxylic group in the side chain are an important feature both for the recognition of α-glucosidase and human recombinant aldose reductase inhibitory activity. Furthermore, the double-bond moiety at C-20 and C-22 in the side chain and the hydroxyl substituent at C-3 of ganoderma acids enlarge the inhibitory activity of both enzymes. These outcomes offer an approach which to regard as the structural requirements of lanostane type triterpenoids acids from G. *lingzhi*.

A consideration of these requirements is essential in order to develop a new type for substances that can be improved to prevent the diabetic complications.

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Green Concept in Engineering Practice

Totok Ruki Biyanto[1]

Abstract – In recent time, becoming green is not only a matter of compliance with regulations, however it is a matter of responding to the expectations and demands of our world, country, community, stockholders, customers, employees and competitors. These matters create tremendous pressure for companies to carry out their activities in a more environmental friendly.

Being green requires the best engineering minds and commitment from the entire organization. Engineering is all about practicality finding solutions to improve the conditions. Excellent understanding of the fundamental engineering is a key to helping industrial activities to become greener and the engineers are in an ideal position to contribute in these activities, in term of development and implementation of technologically sound, as well as cost-effective solutions.

Green initiatives create big business opportunities in the order of trillions of dollars for innovative companies and engineers, in this decade. These business activities are started from research and development, plant design, plant construction and plant operation stage. This paper presents some ideas on how to implement the green concept in engineering activities. The case studies application of green engineering in refinery crude preheat train and cement plant waste heat recovery generation are also presented.

Keywords – Green, Engineering, Practice.

INTRODUCTION

Being green is taking care about sustainablity for the planet and it is not only a compliance matter with regulations but a matter relate to the expectations and demands of community, customers, competitors, employees, and stockholders.

Green practices are frequently considered unaffordable or too expensive, prompting some industries to do just what is required to fulfill the minimum legal requirements. This mindset is obsolete. Today, it is well known that green practices and economic profits have close related. Innovative teams and technical knowledge are required to capitalize on the opportunities to link profitability with environmentally related activities.

It's commonly acknowledged that improvements such as energy consumption and raw material reduction, waste production minimization and process yields maximization are crucial to increase plant economic and profitability.

There are huge opportunities for technically strong and innovative engineers to bring their knowledge and expertise to allow in green activities, in engineering roles start from Resesearch and Development (R&D), process design and operation. Three key driver for green activities are planet, people and profits.

Nevertheless, setting a goal of zero personal injuries, zero accidents and zero process safety incidents are concerned for some other metrics, incorporate with emissions and other waste streams [1].

This paper will presents some ideas on how to implement the green concept in engineering activities, engineering stage, required tools to achieve green and case study in green engineering.

GREEN ACTIVITIES STAGE

Green activities could be performed for new or existing plant, grass root or retrofit. The activites could be done by performing the one or all stages as follow:

A. Research & Development Stage

Green Research and Development (R&D) deals with making sure that green considerations are taken into account during R&D work. There are two focus of R&D for green, the use of more direct chemistry routes can reduce the number of intermediate stages required and developing innovative processes and products. The ideas related to R&D for green as follow:

- Perform practical solutions that have a large impact to society, ie. air pollution, carbon capture and storage, CO_2 emissions, renewable energy, water supply, food production, and economic mass production of vaccines and drugs
- Develop the new processes that provide higher yields, reduced raw material usage, reduced waste and vent streams, reduced energy consumption, minimized environmental impact, etc.
- Develop safety process system that utilize safe raw materials or intermediates and operate at lower temperatures and/or pressures, etc
- Consider biotechnology [2, 3]
- Develop new biodegradable plastics and develop processes for the commercially viable production of them [1]
- Consider green feeds by find out the products or energy that can be made from green materials and develop processes that use renewable raw materials
- Improved catalyst systems to increase efficiency, reduce byproducts, etc. [4]
- Consider others technology options to reduce process steps
- Consider different process scenarios
- Consider material recycles
- Consider membrane-technology as an alternative to distillation and other energy-intensive separation techniques
- Consider environmental impact in solvents selection and if posibble, replace organic solvents with water [1]

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B. Plant design stage

Some ideas on how to be green in this stage will be pointed as follows:

- Apply the process engineering principles and innovative approach to design the plant, in order increase yields, reduced waste, safer operating conditions, reduced energy and utilities consumption
- Apply inherent safety principles, utilize environment friendly materials, reduce inventories, control of the process conditions, etc
- Find out the most effective processes to accomplish the final result
- Reuse waste streams
- Consider Advanced Process Control (APC) techniques to reduced energy consumption or to increased yields and quality control.
- Consider process intensification to maximize throughput and minimize a unit's plot space
- Perform state of art heat-integration studies by using the most advanced software available in the market.
- Reduce waste by design instead of designing for waste treatment
- Fully understand risks associated with the process technologies
- Consider utilizing more efficientt processes and equipment, for example use of highly efficient heat exchangers, boilers, etc)
- Consider high performance tray and packing and trays to improve distillation, liquid-liquid extraction, scrubbing and others mass transfer operations
- Minimize or remove hazardous materials that are harmful to the people or the environment
- Consider variable-speed drives to minimize energy consumption in motors.
- Consider the use of CO2 streams, either as an inert gas in the process or by binding it in the products
- Utilize divided wall columns and reactive distillation
- Consider fuel gas recovery and recompression in flare systems
- Select adequate flowmeters accuracy to ensure that no waste or inefficiencies are created because of improper flowrates measurement
- Design plants taking into consideration potential changes to product or raw material in the future (plant flexibility)
- Consider automated blowdown for boiler, cooling towers
- Consider fouling in heat and mass transfer equipment design
- Use of local materials of construction [1]

C. Plant operation stage

Some ideas on how to be green in plant operation stage are:

- Continuously find out the opportunities to obtain competitive advantages in terms of reduced waste, reduced energy, reduced utilities consumption, higher yields, lower temperatures, reduced reliance on dangerous raw materials or intermediates, etc.
- Operate the plant in optimum parameters. This may sound simple but it is quite important from environmental viewpoints and profitability that it is not always an easy task
- Always find out the opportunities to reduce, reuse and recycle material and energy. First reduce raw materials and energy consumption and waste, reuse or recycle off specification products and excess energy. If reuse or recycle is not practical, consider combine the excess energy with other energy sources and treating any off specification products to a lower value material instead of sending it to waste treatment
- Take steps to prevent waste formation as early as possible instead of relying on waste treatment
- Find uses for byproducts
- Think outside of the box and challenge the traditional mentality
- Develop, implement and analysis the relevant metrics, such as emissions and Btu (or Kcal) per ton of product
- Build a green culture in which safety and environmental stewardship are top priorities and create stretch goals such as zero personal injuries, zero accidents and zero process safety incidents
- Measure, track and minimize emissions of GHGs, Volatile Organic Compounds (VOC) and regulated substances
- In order to minimize risks, costs and emissions, inventories level of raw materials, intermediates and final products should be minimized
- Fully understand the risks and previous accidents associated with the utilized technology and operate accordingly, hence the operator should be trained well.
- When downsizing, make sure that the remaining employees still have adequate knowledge of the technologies, the processes and understand how to minimize risk and emissions
- Properly inspection of equipment and piping insulation to achive maintain energy efficiency
- Repair steam and utility leaks and replace deficient steam traps and flash tanks [2]
- Maintain or replace dirty disposable filters as required to avoid unnecessary and costly pressure drop
- Properly maintain and calibrate flowmeters hence that no waste or inefficiencies are produced as a result of improper flowrates measurement
- Optimize fuel gas to flares and furnaces by controling air to fuel ratio.
- Look for opportunities to reuse water to minimize waste and flow to the sea.
- Measure and minimize process oxygen demand of waste water
- Optimize compressed-air systems to minimize energy consumption [5]

Use local materials (usually the distant less than radius 1000 km for raw materials and spare parts) to

minimize the environmental impact due to excessive transportation.

REQUIRED TOOLS

In order to achive green, the following tools are useful in assessing the plant and evaluate the options that support green-engineering goals. The required tools are as follows:

A. Steady-state simulation

This simulator could be utilized to simulate and accurately analize of mass and energy balances, offline and online energy optimization, compare processes integration and energy consumption, find ways to recycle waste streams, cogeneration, combined heat and power and integrated gasification combined.

B. Dynamic-process simulation

Dynamic response of equipment and control systems could be simulated and analyzed using this software. Configuration of process control strategy and controller tuning that provide more stabilility, energy safe and reliable could be simulated using dynamic process simulation.

C. Advanced process controls

Off line optimization will set the setpoint to achieve maximal yield, minimum quality variation and maximal energy saving. Multivariable control and on line optimization help run the plants at stable and optimal conditions, the stable plants are more energy efficient and more safe.

D. Pinch analysis

Optimization of utilities usage by matching heating and cooling loads of strems ie. steam, cooling water, firing, refrigreation and jeat integration could be perform by considering this method.

E. Separations design

Synthesis of separation equipment could be arranged for new separation or improving existing schemes. It will help to reduce the number of columns in complex separations trains amd energy consumption reduction.

F. Detailed heat exchanger design tools

Sizing, rating and simulation of a heat exchangers can be performed using mechanical software. The dimension, geometry, fluid mechanical, heat transfer, fouling and overal heat transfer coeficient of a heat exchanger are optimized. It include minimizing capital cost of heat-exchanger design. Hence, detailed exchanger performance analysis combined with simulation can improve estimation of the effect of heat-exchanger fouling on energy efficiency.

G. Cost-estimation software

Estimate costs as early as possible in the project will provide the energy efficiency features or saving and reduce investment cost. It is make easier for engineers to do process design in parallel with cost estimation of process alternatives.

H. Computational Fluid Dynamics (CFD)

Analysis of flow patterns, pressure and temperature distribution inside vessels, and other equipments. Better mixing and flow distribution can allow higher heat transfer from hotter process to cooling systems.

CASE STUDY

During conceptual stage, the opportunity to increase energy efficiency is highest. Typically about 98% of operating cost and 80% of capital cost are determined during Front End Engineering Design (FEED). Steady state simulation, pinch analysis tools, and others conceptual design software are very useful during this stage.

In this stage, should be continuously looking for the opportunity to utilize low energy process technology such as adsorption, membrane separators and pervaporation [6]. Identify the best location for a new plant. Use supply chain technologies and services to identify locations that reduce transportation costs and inventories.

Safety and health are more important than profitability. Consider designs that are safer for workers and environmentally benign even if slightly less profitable. Safety and environmental responsibility are justifications for longer pay-back periods; you will save on insurance and avoid fines

Balance the tradeoff between capital and energy costs. Capital is spent once, but you will pay for energy over and over again with near zero chance its cost will decrease in the future. However for existing plant, assess the energy efficiency of your plants and compare it to your industry average and to available technologies first. Train the operators to know the variables that influence energy efficiency. Process training and training simulators are suitable tools for this purpose.

Learn all aspects of the plant process. If the engineers can't run or model your plant process theirself, the engineers probably don't understand it, in which case they should rely on others parties that can provide advise on energy improvements and related technologies.

Seek technologies and knowledge from other industries. Partners from other industries often can help to identify efficiency solutions that it is applicable to your process and consider revamping or retiring old plants, estimate recoverable energy waste, and identify current and future costs.

Also, consider using waste heat from your neighbors, such as power plants, cement plant, refinery, etc. For indirect heating consider to utilize Combined Heat and Power (CHP). CHP delivers steam and electricity for essentially the same fuel cost as steam alone. Although additional capital cost is required, CHP projects typically payback period quickly.

In order to achieve the goal, operation and maintenance should be support with sufficient technologies. Advanced process controls and online optimization are proven technologies that can help save large quantities of energy and raw materials Perform complex-wide optimization because,

optimization of individual systems seldom equals a more broadly based analysis of the plant.

Maintenance heat transfer equipment in clean conditions will keep the equipment efficiency in certain conditions. Especially for heat exchangers, it will make the facilities more efficient. Hence, optimization of heat exchanger cleaning schedule is required.

A. Fouling Mitigation in Refinery Crude Preheat Train

Chemical processes convert one or more chemicals or chemical compounds into more valuable products. Energy plays a major role in all chemical processes and contributes significantly to the processing costs. The data on specific energy consumption for some of the major chemical products are shown in Table 1 [7].

Chemical industries constantly strive to reduce the specific energy consumption to a lower level and thereby increase the profit margin and also reduce carbon dioxide emission. Increasing energy cost is also a major concern for the chemical industries. For example, the crude oil price has risen from USD 30/bbl in the year 2000 to USD 100/bbl or above in ten years [8].

Improved process technologies, process operation and heat recovery through heat integration are some of the approaches employed by the chemical industries to reduce the energy consumption. Heat integration involves the use of a network of heat exchangers whereby the heat in the product or intermediate streams is recovered into the feed streams. This approach reduces the heat loss through the product streams while it also reduces the energy required to heat the feed streams.

Heat integration can be applied in heat exchanger networks, reactors, distillation columns, evaporators and dryer, etc., [9]. For example, heat integration study to investigate improving energy efficiency between Crude Distillation Unit (CDU) and Residue Cracking Unit (RCU) was preformed [10]. The results showed that the heat transferred from RCU to CDU reduced the CDU requirements by 40% for a new or grass roots design. RCU retrofit designs were developed to increase steam generation by up to 35% and in line with targeting estimates would appear to have economic potential.

Unfortunately, fouling in heat exchangers is an undesirable process that reduces the realization of the maximum benefits of heat integration. Fouling is the accumulation of unwanted deposits on the surfaces of heat exchangers that represents a resistance to the transfer of heat and, therefore, reduces the efficiency of the particular heat exchanger. The foulant may be crystalline, biological material, products of chemical reactions including corrosion, or particulate matter [11, 12]. The character of the deposit depends on the fluid (liquid or gas) passing through the heat exchanger. The pressure drop across the fouled heat exchanger units increases due to the reduction in the flow area and consequently increases the pumping costs [13].

Fouling occurs in many industrial processes. Several studies have been reported in the literature on fouling in industries such as petrochemical industry [14], dairy plants [15], biomass boilers [16], etc. Optimization of cleaning scheduling in heat exchanger networks subject to fouling in sugar industry has been studied [17]. Macchietto et al. reported that until now, the problem of fouling in crude oil preheat trains still remains unsolved [18.

Crude Preheat Train (CPT) in petroleum refinery represents one of the major heat integration units. In a CPT, crude oil is heated from ambient temperature to about 230 ^{o}C before entering the furnace. The heating mediums in the CPT are the products and pump-around streams from the CDU. The CPT recovers about 70% heat from the products and serves as a product cooler. Without the CPT, 2-3% of product would be used to heat up the crude in the furnace, as shown in Figure 1.

Engineering Sciences Data Unit (ESDU) reported that fouling in CPT is a very serious problem [19]. This problem results in additional energy consumption and affects the plant economy in billions of dollars per annum. The two main impacts of fouling on preheat train operation are (i) reduced heat recovery and (ii) increased pressure drop. For a processing unit of 100,000 bbl/day, a drop in Coil Inlet Temperature (CIT) due to the fouling by 1 K resulted in approximately £ 25,000 of additional fuel cost and 750 te of additional carbon dioxide each year [20]. On both economic and environmental basis, there are great motivations to minimize fouling while maximizing heat recovery in the heat exchanger networks.

Increased pressure drops result in reducing throughput in the refinery. It often becomes the most significant cost of fouling in most refineries. For a refinery with a capacity of 100,000 bbl/day and assuming a marginal lost production of £1.2/bbl, every 10% throughput reduction would cost £12,000 per day [20, 21]. In many refinery operations, the pressure drop problem can be more severe [22]. In the USA, fouling in crude distillation units costs went up to US$ 1.3 billion in 1995 [23]. Fouling cannot be avoided, yet it can be mitigated. Therefore, effective fouling mitigation techniques are important [13].

Fouling mitigation techniques include (i) addition of antifoulant chemicals, (ii) design of more efficient heat exchangers and (iii) periodic cleaning of heat exchangers. Each fouling mitigation technique has its own drawbacks. Adding antifoulant increases operating cost. Successful applications of this method have been reported in literature and the annual cost attributable to fouling has been reduced by almost 50%, even by taking into account the cost of the antifoulants [24].

It has also been reported that the use of an antifoulant reduced the decline of the heat-exchanger performance [25]. However, an analysis on the effects of fouling on the overall performance of individual preheat-train heat exchangers using antifoulant chemicals found that two of the commercial antifoulants used were ineffective [26]. Thus, selection of suitable antifoulants is needed which is indeed a very difficult task.

Better design of heat exchangers such as improvements on the mechanical design by designing proper tube and baffles arrangement was able to reduce the fouling tendency [27, 28]. Generally, the designer take into account the industry standard TEMA fouling factors by which heat-transfer surface area is added to make up the lost performance due to fouling. HTRI and TEMA [29] estimated that 11% to 67% more heat-transfer surface area is added in the heat exchangers to compensate for the effects of fouling. Garrett and Price [27] estimated that an additional heat-transfer surface area of 30–40% adds around 25% to the equipment price. Although, retrofitting with more efficient heat exchangers and installing redundant heat exchangers can overcome the problem of fouling, the capital cost of the HEN increases [28, 30].

The other alternative is to perform periodic cleaning of the fouled heat exchangers. Cleaning of heat exchangers involves additional expenditure and possibly, shutting down the plant resulting in the loss of production. Less frequent heat exchanger cleanings may lead to higher costs due to increase in the heat loss and added pressure drop.

The heat-recovery performance of heat exchangers reduces due to fouling, which results in increased heat duty requirement in the furnace. This also raises fuel costs and increases CO_2 emissions from the fired heater. In a refinery with high fouling rate, the loss of heat-recovery performance can require up to 10–15% higher furnace duty [22]. The increase in CO_2 emissions means that a refinery has to pay for more CO_2credits. A CO_2credit is valued at around US$ 20/ton. Using a furnace-fuel cost of US$ 40/bbl, the emission cost ends up at around 25% of the increased fuel cost. In addition, exceeding the CO_2 limits can bring to additional penalties of EUR 100/ton of non-credited CO_2 emitted [20].

It is shown that around 1–5% of the energy consumed by the industrial sector is used to pay for excess fuel burnt and additional electricity consumption due to fouling [27]. Therefore, fouling can cost a refinery up to 5–10% of their production capacity. Conversely, higher costs would be incurred when the heat exchanger is cleaned too frequently. Consequently, an optimization of cleaning schedule is important, to determine an optimal cleaning interval for each heat exchanger in a HEN. The results showed that efficiency of CPT 23% increased which can be translated in IDR 14.1 Billion of fuel saving [31].

B. Waste Heat Recovery Generation (WHRG) in Cement Plant

The cement industry is one of the most energy intensive industries. Basically, in modern portland cement processing consist of quarry, raw meal preparation, preheating of raw meal, kiln, clinker cooling, grinding, storage and dispatch. In preheater tower chemical reaction starts with the decomposition of calcium carbonate ($CaCO_3$) at around 900°C to leave calcium oxide (CaO, lime) and release CO_2; this process is called calcination.

Commonly, in this process, fossil fuels such as coal, petcoke and natural gas is burnt to get the required thermal energy consumption [32]. Cement production plant requires approximately 1.7 tons of limestone as major raw materials per ton of produced clinker and 3.2 to 6.3 GJ of energy consumption [33, 34]. Cost of energy is about 60% of the production costs.

At the end of this process, 20 to 50% of the consumed energy is lost as waste heat that contained in the flow of hot gases, solids and liquids, as product or by product stream. An alternative approach to improve energy efficiency is to recover the waste heat. In some cases, such as industrial furnaces, the efficiency increased about 10% - 50% by utilization of waste heat energy recovery. Regarding to green engineering purpose the study of heat recovery in cement plant is performed as shown in Figure 2.

The results show that a cement plant in Tuban could produced 28 MW electricity in dry season and 20 MW in rainy season. In the other hand, implementation of WHRG resulted in the fuel savings that could be represented as reduction of CO_2 emissions. Hence, for emissions reductions due to the utilization of WHRG is about 20 MW is 14 MT CO_2 per year [35].

CONCLUSION

Some ideas on how to implement the green concept in engineering activities, engineering stage, required tools to achieve green and case study in green engineering have been presented in this paper. In two case study have been shown that application green engineering at design stage of WHRG in cement plant and retrofitting existing CPT in refinery and optimization of cleaning schedule provide improvment in economical and environment result.

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REFERENCES

[1] Nair, Sukumaran, “What are the strategies for sustainable chemical production”, Hydrocarbon Proc., Jan. 2011, pp. 69–77.
[2] Ottewell, Sean, “Sustainability Sustains its Appeal”, Chem. Proc., Nov. 2009, pp. 21–24.
[3] Ottewell, Sean, “A Different Plant Appears on the Horizon”, Chem. Proc., Aug. 2009, pp.14–18.
[4] Hall, Nina et al, “The New Chemistry,” Cambridge University Press, 2000.
[5] Bravo, Fabio, others, “Wisely Use Emergency Scrubbers with Vent Systems”, Chem. Eng. Prog., Aug. 1997, pp. 62–68.
[6] “Separation Technologies for the Industries of the Future” Publication NMAB-487-3, National Academy Press, Washington, D.C., 1998.
[7] *Tracking Industrial Energy Efficiency and CO_2 Emissions*. Paris, France: International Energy Agency, 2007.
[8] Energy Information Administration, "Annual Energy Outlook 2012," U.S. Department of Energy 2012.
[9] R. Smith, *Chemical process design and integration*: Wiley New York, 2005.
[10] A. L. Querzoli, A. F. A. Hoadley, and T. E. S. Dyson, "Identification of heat integration retrofit opportunities for crude distillation and residue cracking units," *Korean Journal of Chemical Engineering,* vol. 20, pp. 635-641, 2003.
[11] J. Rehman Khan and S. M. Zubair, "A risk based performance evaluation of plate-and-frame heat exchangers," *Heat and Mass Transfer,* vol. 39, pp. 327-336, 2003.

[12] T. R. Bott, *Fouling of Heat Exchangers*. Amsterdam: Elsevier Science & Technology Books, 1995.
[13] F. Smaïli, V. S. Vassiliadis, and D. I. Wilson, "Mitigation of fouling in refinery heat exchanger networks by optimal management of cleaning," *Energy & Fuels,* vol. 15, pp. 1038-1056, 2001.
[14] K. Brodowicz and M. Markowski, "Calculation of heat exchanger networks for limiting fouling effects in the petrochemical industry," *Applied Thermal Engineering,* vol. 23, pp. 2241-2253, 2003.
[15] C. Riverol and V. Napolitano, "Estimation of fouling in a plate heat exchanger through the application on neural networks," *Journal of Chemical Technology and Biotechnology,* vol. 80, pp. 594-600, 2005.
[16] L. M. Romeo and R. Gareta, "Hybrid System for fouling control in biomass boilers," *Engineering Applications of Artificial Intelligence,* vol. 19, pp. 915-925, 2006.
[17] F. Smaïli, D. K. Angadi, C. M. Hatch, and O. Herbert, "Optimization of scheduling of cleaning in heat exchanger networks subject to fouling: sugar industry case study," *Food and Bioproducts Processing,* vol. 77, pp. 159-164, 1999.
[18] S. Macchietto, G. F. Hewitt, F. Coletti, B. D. Crittenden, D. R. Dugwell, A. Galindo, G. Jackson, R. Kandiyoti, S. G. Kazarian, and P. F. Luckham, "Fouling in crude oil preheat trains: a systematic solution to an old problem," in *Heat Transfer Engineering*, 2009, pp. 197-215.
[19] ESDU, "Heat exchanger fouling in the preheat train of a crude oil distillation unit," ESDU, London 2000.
[20] B. L. Yeap, "Design of heat exchanger networks with fouling mitigation," in *CGPS* dissertation: University of Cambridge, UK, 2001.
[21] B. L. Yeap, D. I. Wilson, G. T. Polley, and S. J. Pugh, "Mitigation of crude oil refinery heat exchanger fouling through retrofits based on thermo-hydraulic fouling models," *Chemical Engineering Research and Design,* vol. 82, pp. 53-71, 2004.
[22] B. L. Yeap, D. I. Wilson, G. T. Polley, and S. J. Pugh, "Retrofitting crude oil refinery heat exchanger networks to minimize fouling while maximizing heat recovery," *Heat Transfer Engineering,* vol. 26, pp. 23-34, 2005.
[23] W. Ebert and C. B. Panchal, "Analysis of Exxon crude-oil-slip stream coking data," *Fouling mitigation of industrial heat exchangers, San Luis Ebispo, CA (United States), 18-23 Jun 1995,* 1995.
[24] W. L. Van Nostrand, S. H. Leach, and J. L. Haluska, "Economic penalties associated with the fouling of refinery heat transfer equipment," *Fouling of heat transfer equipment,* pp. 619-643, 1981.
[25] S. H. Leach and S. A. Factor, "Monitoring fouling in refinery and petrochemical plant heat exchange equipment," in *20th National Heat Transfer Conference. ASME*, 1981, p. 39.
[26] D. Lawler, "Fouling of Crude Oil in Refinery Heat Exchangers," in *Proceeding of the Conference on Fouling, Science or Art, The Institute of Chemical Engineers* UK, 1979.
[27] B. Garrett-Price, "Fouling of Heat Exchangers: Characteristics, Costs, Prevention, Control and Removal," *Noyes Publications, 1985,* p. 417, 1985.
[28] S. Sanaye and B. Niroomand, "Simulation of heat exchanger network (HEN) and planning the optimum cleaning schedule," *Energy Conversion and Management,* vol. 48, pp. 1450-1461, 2007.
[29] J. Chenoweth, "Final report of the HTRI/TEMA joint committee to review the fouling section of the TEMA standards," *Heat Transfer Engineering,* vol. 11, pp. 73-107, 1990.
[30] M. C. Georgiadis, L. G. Papageorgiou, and S. Macchietto, "Optimal cyclic cleaning scheduling in heat exchanger networks under fouling," *Computers & Chemical Engineering,* vol. 23, pp. S203-S206, 1999.
[31] Totok R.Biyanto, 'Algoritma Genetika untuk Mengoptimasi Penjadualan Pembersihan Jaringan Penukar Panas', Jurnal Teknik Industri, Vol. 17, No. 1, Juni 2015
[32] Van Oss HG, Padovani AC. Cement Manufacture and The Environment, Part I: Chemistry & Technology, Journal of Industrial Ecology 2000; 6: 89-105.
[33] Van Oss HG, Padovani AC. Cement Manufacture and The Environment, Part II: Environmental Challenges and Opportunities, Journal of Industrial Ecology 2003;7: 93-126.
[34] GERIAP, Company Toolkit for Energy Efficiency, Industry Sectors – Cement, 2005. http://www.energyefficiencyasia.org/docs/IndustrySectorsCement_draftMay05.pdf, Accessed on May 10, 2012.
[35] ITS Kemitraan, Study Evaluasi Waste Heat Power Generator Dari Exit Gas Raw Mill Dan Cooler, Project Report, 2013.

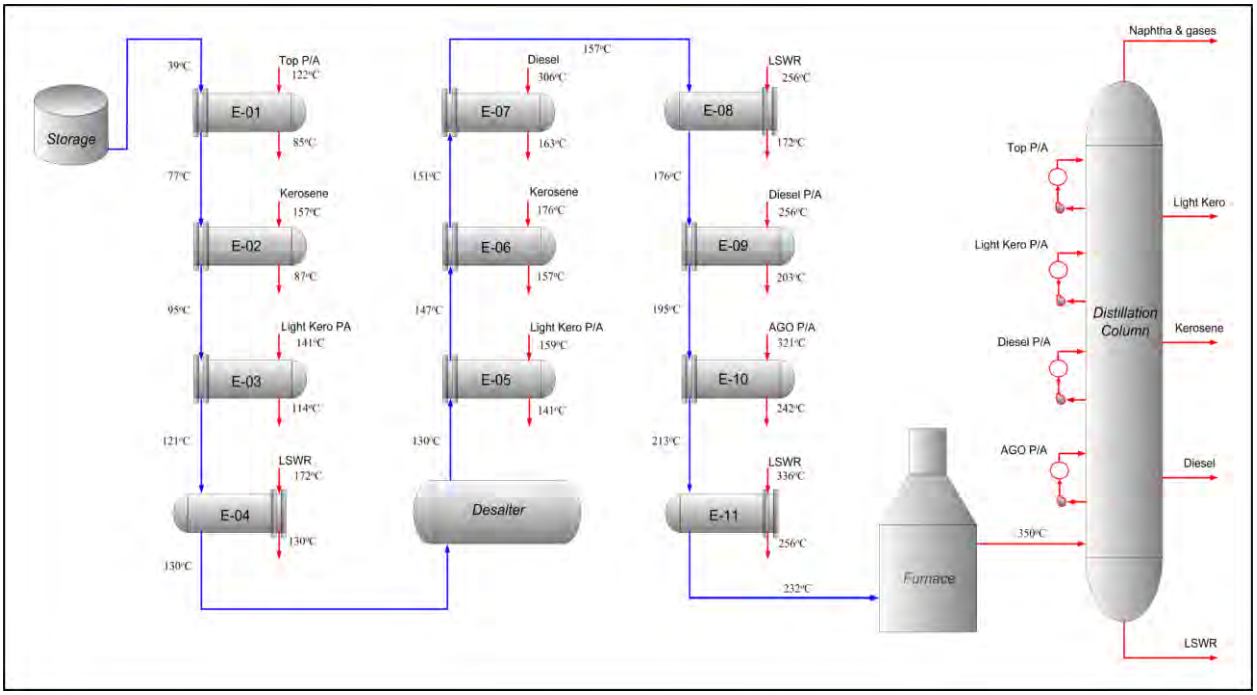

Figure 1. The schematic diagram of the CPT

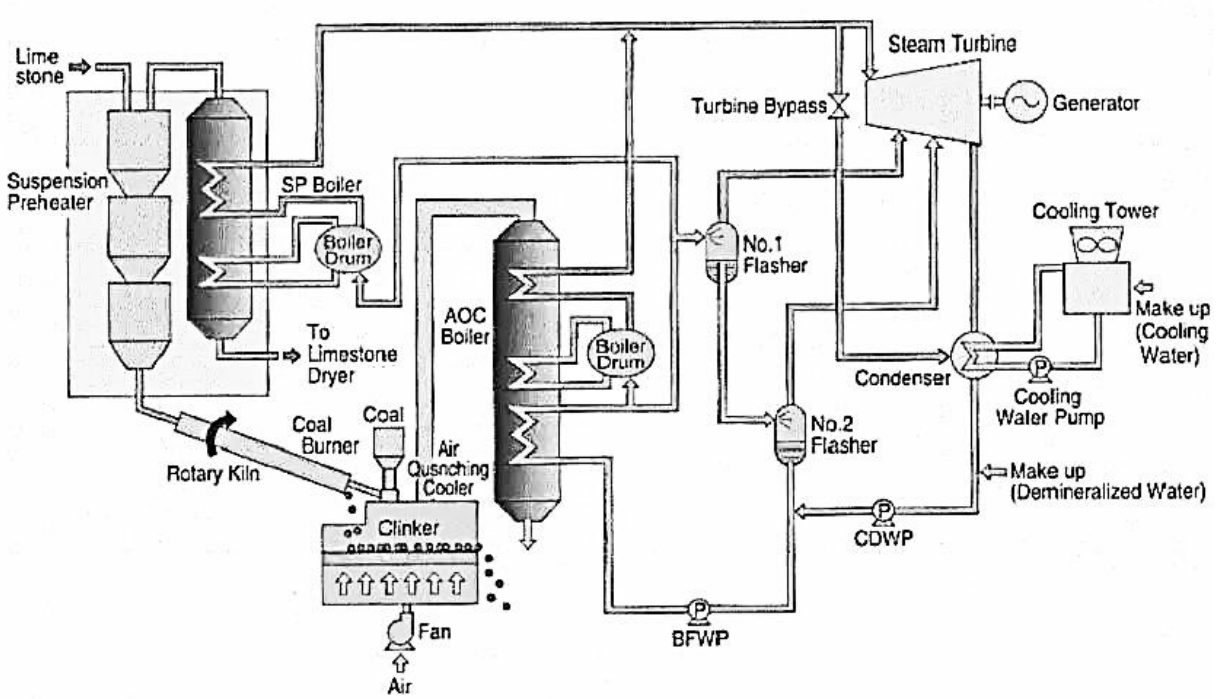

Figure 2. PFD of SP and AQC Boiler in WHRG of Cement Plant

Table 1. Estimated energy consumption for major chemical products

Product name	Volume	Feedstock	Heat	Steam	Energy use including electricity
	ktonnes/yr	GJ/tonne	GJ/tonne	GJ/tonne	GJ/tonne
Benzene steam cracking	14,680	42.60	20.07	7.01	69.68
Ethylene	103,283	47.20	12.80		60.00
Methanol	34,668	20.00		8.50	28.50
Propylene	42,928	46.70	13.30		60.00
Polyethylene, high density	29,969			1.40	1.40
Polypropylene	38,214			1.40	1.40
Polyvinyl chloride	30,042			2.20	2.20
Ammonia	140,000	21.00	7.00		28.00
Sodium Hydroxide& Chlorine	45,000		0.60		0.60

Simulation Bursting Effects To The Performance Vertical Axiz River Turbine Using Computational Fluid Dynamics

Aank Suseno[1], Ridho Hantoro[1], and Gunawan Nugroho[1]

Abstract-Turbulent flow in the open channel, often exhibit a phenomenon bursting in expansion or inhibition case. This phenomenon disturbing to the flow at the turbine area. In this study, Research to analyze the occurrence of interference bursting in the river turbine area, done by simulating the river flow with a variety of depths ratio y/L, using vertical turbine NACA 0018 in a trapezoidal channel, with k-ε turbulence models in CFD. From the simulation results the smaller ratio of the depth y/L, the force of turbulence flow (bursting flow) at the turbine increases.

Index Terms - Channel, CFD k-ε, Bursting.

INTRODUCTION

If the channel undergoing expansion, there will be a behavior experienced positive pressure gradient and unstable flow, the flow make recirculation zone in the area around the wall. In this zone, the direction opposite to the direction of the main stream flow. These conditions resulted unstable and turbulent nature flow. At the zone of turbulent flow structure will be formed periodically through is called the phenomenon of bursting. At certain recirculation zone velocity fluctuations become large and may exceed the average speed of the flow [1]. The researchers partly reviewing and searching for the best solutions that approach the natural results (experimental) fluid behavior in the various forms of open channels, especially in sea and river cannel [2]. One of the studies apply a 3D numerical models to calculate the flow in a curved open channel, which solves the Reynolds-averages fully 3D Navier-Stokes equations With turbulence models [3,4]. Non linear simulation model of turbulence k-ε introduced in this study [5,7]. Non linear simulation model of 3D turbulence k-ε present good results to investigate the flow structure, the distribution of velocity and mass transport processes in the various forms of surface channels. Kamel Benoumessad's study refers to a solution solving the Navier-Stokes equations in cylindrical coordinates Reynolds turbulence model with standard k-ε [6]. Using the same model of turbulence, this research was conducted simulated river flow on a vertical turbine. The main contribution of this study focuses on the analysis characteristics of turbulent flow, analysis the formation of the bursting phenomenon in trapezoidal channels and bursting phenomenon effect to the performance of the turbine.

METHOD

Geometry models in this simulation are turbine NACA 0018 and trapezoidal cross section channel. Geometry model turbine and the channel has dimensions as shown in Figure 1.

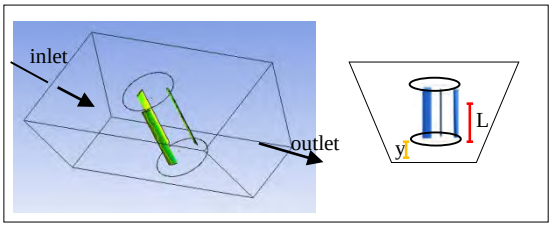

Figure 1. Geometry Model In Simulation.

Geometry model turbine and channel as shown in Figure 3.1 then simulated with some variation of the ratio depth of treatment turbine (turbine placement) y/L and the flow velocity (v). Simulations performed using trapezoidal channel models with a channel length of 270 cm, 140 cm depth flow and free surface width of 120 cm. Turbine used is NACA 0018 with a turbine diameter D = 40 cm of length L = 80 cm, the turbine is located at a distance of x = 110 cm from the beginning of the main channel (inlet). The position of the turbine is placed at a height y from the base channel. Height ratio of the turbine to be simulated by varying the value of y/L and velocity flow (v). In this study used a model of turbulence k-ε because this model has good accuracy to observe the turbulent flow in the turbine wall to areas away from the turbine. Where convergence in this study achieved with 500 iterations. The magnitude of the forced bursting flow is calculated using a turbine wheel that forces fluid flow around the turbine rotates with vortex force (Fc) on the surface of the water within (r) from the center axis of the rotary flow. Forced rounds of this turbine will cause the fluid centrifugal force is proportional to the weight of the

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fluid particles (w) and the rotation of the particles urgent compulsion (ω). The equation of vortex centrifugal force (Fc) is

$$Fc = \frac{W}{g}\omega r^2 \quad (2.1)$$

RESULTS AND DISCUSSION

Bursting phenomenon arising at turbine has a different value of bursting forces and area (radius of vortex). Differences flow rate also affects the size of the force vortex bursting. High flow rate causes the flow of oncoming fill the area behind the turbine has a higher value, but the style vortex is formed not by force vortex caused by the flow at low speed. This is due to the flow of the turbine rotation speed increases, so there is a lot of fluid mass that rotates behind the turbine due to carry over into the downstream flow. Flow at high speed which has low vortex style also has a sweep radius lower than the flow at low speed. This is due to the rapid recirculation event that caused the flow.

By increasing the ratio of y/L, at the same speed conditions, causing style downward spiral. This decrease was due to the influence of pressure ekstrac. Relations depth ratio y/L with style vortex that occurs is shown in Figure 2.

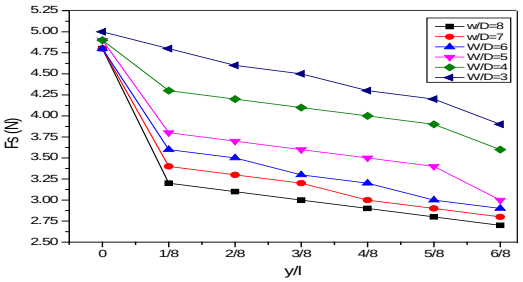

Figure 2. The Influence Of The Ratio Of The Depth Y/L To Force The Vortex (Fs).

decreased flow velocities inlet cause increased flow turbulence as well as the style vortex occurs, vortex style foil blocking flow increased due to the longer time compared to the high flow rate. Figure 3 shows the relationship between the time a turbine wheel with whirlpool style

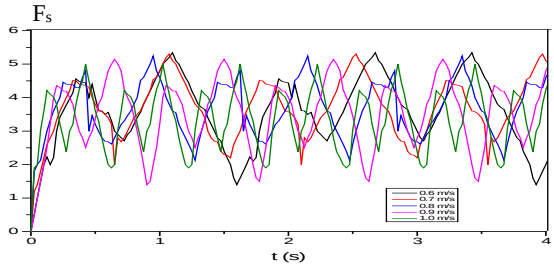

Figure 3. Bursting Force (Fs) Of The Time Vortex Turbine Wheel (t).

Bursting phenomenon that occurs behind the turbine speed in the opposite direction to the direction of rotation of the turbine, so it can be a nuisance drag force on each foil turbine. But this effect does not last long because every bursting released by each foil on the turbine will soon be filled by the next foil.

CONCLUSION

Based on the research concluded that the different pressure distribution flow at the turbine area because of turbin blockage, making the flow turning from high pressure into the direction toward the lower pressure, create bursting which disrupt the performance of turbine. The bursting force against the direction of rotation of the turbine. And obtained the bursting force will be increased by lowering the ratio of the depth and lower flow velocity.

REFERENCES

[1] M. Syahril B. Dkk. Studi Pengembangan Model Turbulen κ-ε untuk Sirkulasi Arus II: Aliran Turbulen Dua Dimensi pada Saluran Ekspansi. PROC. ITB Sains & Tek, 2007;Vol. 39 A No. 1&2:70-96.

[2] H. Shamloo. Analysis of roughness density and flow submergence effects on turbulence flow characteristics in open channels using a large eddy simulation. Applied Mathematical Modelling, 2015, vol. 39, pp. 1074–1086.

[3] Y. Shimizu, H. Three-dimensional computation of flow and bed deformation. Journal Hydraul, vol. 116, pp.1090–1108, 1990.

[4] T. Kawamura. Numerical simulation of 3D turbulent free-surface flows. International Research Center for Computational Hydrodynamics, Horsholm, Denmark, 1998.

[5] L. Shen. Large-eddy simulation of free-surface turbulence. The Journal of Fluid Mechanics, vol. 440, pp. 75-116, 2001.

[6] K. Benoumessad. 3D simulation of velocity profile of turbulent flow in open channel with complex geometry. Physics Procedia, 2014, vol. 55, pp. 119–128.

Economical Aspect of Heat Exchanger Cleaning Affected by Fouling

Mades Darul Khairansyah[1] and Totok R. Biyanto[1]

Abstract - Fouling is the accumulation of foulant in a heat exchanger. Fouling increases the pressure drop and energy loss. Losses due to fouling in the distillation unit for crude oil reached US $ 4.2-10 billion per year in the United State. Fouling couldn't be avoided, but it could be mitigation. One of the mitigation method is periodic cleaning of the heat exchanger. The time interval of a heat exchanger cleaning schedule is 1-36 months. Energy recovery, additional costs due to the performance of the pump and the cleaning cost are used as variables to determine saving. Results from this research showed that the heat exchanger is cleaned at 9 month is optimal cleaning schedule. Heat exchanger has savings about IDR 7.9 billion at 9 month. The amount is derived from the energy recovery about IDR 8.8 billion, reduced by a cleaning cost about IDR 0.2 billion and the advantage due to additional pumping cost about IDR 1.1 billion.

Index Terms - Cleaning schedule, fouling, heat exchanger, optimization.

INTRODUCTION

Heat exchanger is an equipment to minimize energy used. Heat exchanger usually use in a chemical process [1]. The main function of heat exchanger is recover heat from the product stream. Heat exchanger transfer of heat from hot fluid to cold fluid.

Fouling is the accumulation of deposit /foulant in a heat exchanger [2]. Fouling increases the pressure drop and decrease energy loss. The pressure drop occurs in the heat exchanger because fouling decrease flow area thereby increasing the additional cost of pumping [3]. Loss of energy derived from the heat transfer in the heat exchanger. The increase in fouling resistance will decrease the overall heat transfer coefficient thereby the heat transfer decreases. Losses due to fouling in the distillation unit for crude oil reached US $ 4.2-10 billion per year in the United State [4].

Fouling couldn't be avoided, but it could be mitigation. Therefore, effective mitigation techniques fouling is very important [3]. Fouling mitigation techniques include (i) the efficient design of heat exchanger, (ii) the addition of antifoulant chemicals and (iii) periodic cleaning of the heat exchanger.

Each fouling mitigation technique has its own drawbacks. Better design of heat exchangers such as improvements in the mechanical design by designing appropriate tube and baffle arrangement could reduce the effect of fouling [5]. Lawler estimates that the addition of heat transfer surface area of 30-40% will increase 25% the price of the equipment [5]. Installation costs for larger heat exchanger increase due to stronger foundation and more space area are needed. Additional heat transfers surface area increase installation costs. Installation cost for heat exchangers is estimated 2-3 times of purchasing cost [3].

Additional chemicals antifoulant increase operating costs. Application of this method has been successfully reported in the literature, the annual costs decrease because fouling has been reduced up to 50%, with consider of antifoulant cost [6]. Using antifoulant reduce performance of heat exchangers. Antifoulant chemicals corresponding very difficult to study [7].

Another alternative is clean heat exchanger periodically. Heat exchanger is cleaned when heat exchanger in fouled condition. Cleaning heat exchanger periodically is used to recover the thermal efficiency of the heat exchanger. Cleaning heat exchanger increase additional cost and may require to shut down the refinery which resulted in lost production. Cleaning heat exchanger rarely increase annual cost because it increase heat loss and increase pressure drop. Fouling in the refinery increase cost up to 5-10% from production capacity. On the other hand, higher cost will occur when the heat exchanger is cleaned frequently. Thereby, the appropriate cleaning heat exchanger is important to determine optimal cleaning interval for a heat exchanger [8].

METHOD

In this paper, a heat exchanger cleaning schedule will be discussed. The time interval of a heat exchanger cleaning schedule is not more than 29 months [9]. Thereby, time interval that is used in this research is 1-3 years or 1-36 months. Energy recovery, additional costs due to the performance of the pump and the cleaning cost are used as variables to determine saving.

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RESULTS AND DISCUSSION

The growth of fouling would be decrease energy recovery. Cleaning every 6 month is maximum energy recovery. Maximum energy recovery is about IDR 53.85 billion. Cleaning frequently not guarantee have big amount from energy recovery. It's only have energy recovery about IDR 47.57 billion if cleaning every month. Aside from cleaning every month, if heat exchanger clean rarely it could be minimum energy recovery. It's only have energy recovery about IDR 44.60 billion. Thereby cleaning every 6 month is the optimal amount from energy recovery point.

Fouling decrease diameter of inner tube. Cleaning every month is minimum pump cost. Minimum pump cost is about IDR 0.43 billion.

Cleaning frequently have big amount from pump cost. Aside from cleaning every month, if heat exchanger clean rarely it would be maximum pump cost because diameter inner tube would be decrease when heat exchanger clean rarely. Thereby cleaning every month is the optimal amount from pump cost point. Cleaning frequently increase cleaning cost. Cleaning every month is maximum cleaning cost. Maximum cleaning cost is about IDR 12.65 billion. Aside from cleaning every month, if heat exchanger clean rarely it would be minimum cleaning cost. Thereby cleaning every 36 month is the optimal amount from cleaning cost point.

Saving obtained from energy recovery, pump cost and cleaning cost. Maximum saving obtained from maximum energy recovery, minimum pump cost and minimum cleaning cost. Maximum saving is cleaning every 9 month.

Maximum saving is about IDR 7.95 billion. The amount obtained from the total energy recovery of heat exchanger in under clean schedule (*Energy Recovery* $_{cs}$ - *Cleanup Costs* $_{cs}$ – *Pump Cost* $_{cs}$) subtract the total energy recovery under fouled condition (*Energy Recovery* $_{fouled}$ – *Pump Cost* $_{fouled}$). Where the net energy recovery in under clean schedule is IDR 51.89 billion subtract total energy recovery under fouled condition is IDR 43.94 billion obtained saving IDR 7.95 billion.

CONCLUSION

Results from this research showed that the heat exchanger is cleaned at 9 month is optimal cleaning schedule. Heat exchanger has savings about IDR 7.9 billion at 9 month. The amount is derived from energy recovery about IDR 8.8 billion, reduced by a cleaning cost about IDR 0.2 billion and the advantage due to additional pumping energy about IDR 1.1 billion.

REFERENCES

[1] Á. Martín and F. a. Mato, "Hint: An educational software for heat exchanger network design with the pinch method," *Educ. Chem. Eng.*, vol. 3, no. 1, pp. 6–14, 2008.

[2] T. R. Bott, *Fouling of Heat Exchanger*, 26th ed. Amsterdam: Elsevier Ltd, 1995.

[3] F. Smaïli, V. S. Vassiliadis, and D. I. Wilson, "Mitigation of fouling in refinery heat exchanger networks by optimal management of cleaning," *Energy and Fuels*, vol. 15, no. 5, pp. 1038–1056, 2001.

[4] L. Wang, B. Sundén, and R. M. Manglik, *Plate Heat Exchangers: Design, applications and performance*, vol. 25, no. 3. Southampton, UK: WIT Press, 2007.

[5] D. Lawler, *Fouling of Crude Oil in Refinery Heat Exchangers*. UK, 1979.

[6] W. L. Van Nostrand, S. H. Leach, and J. L. Haluska, "Economic penalties associated with the fouling of refinery heat transfer equipment," *Fouling heat Transf. Equip.*, pp. 619–643, 1981.

[7] T. R. Biyanto, *Optimal cleaning schedule for crude pre heat train affected by fouling using genetic algorithm*. Bandar Seri Iskandar, Perak: Universiti Teknologi Petronas, 2013.

[8] S. Sanaye and B. Niroomand, "Simulation of heat exchanger network (HEN) and planning the optimum cleaning schedule," *Energy Convers. Manag.*, vol. 48, no. 5, pp. 1450–1461, 2007.

[9] T. R. Biyanto, S. W. Suganda, Y. Susatio, and H. Justiono, "Cleaning Schedule Optimization of Heat Exchanger Networks Using Particle Swarm Optimization," in *Applied Science for Technology Innovation*, 2014, no. August, pp. 13–14.

Cost Optimization In The Scheduling On Heat Exchanger Cleaning Process

David Licindo[1], Renanto Handogo[1], and Juwari Purwo Sutikno[1]

***Abstract* – Cost utility is very important in an industry, particularly in the chemical industry. For an industry that operates the heat exchanger in the production process, utility usage is determined by the maintenance of this devices, one of which is cleaning. Therefore, it is necessary to schedule the optimal cleaning in order to obtain optimum expenses as well. in this paper, a cost optimization model has been developed to obtain ideal scheduling that takes into account the time of cleaning with minimum targets utility costs. Simple case study problem will be given to show the application and the results**

***Index Terms* – Cost utility, heat exchanger, optimization, scheduling.**

INTRODUCTION

The rationale for the optimization of utility costs depend on the characteristics of heat exchanger fouling [1]. These characteristics follow an exponential function $U = a.e^{-b.t}$

Additional utility is used when the efficiency of heat exchangers decreased as a result of fouling so that the process can keep running. So that the benefits of cleaning is to restore the working efficiency of the heat exchanger to the optimum condition [2]. Various fouling characteristics models have been developed, for example two layer model [3], fouling effect on the output temperature and extended to networks of heat exchanger [4].

MODEL FORMULATION

The objective Function of this problem is defined as follows, to find Minimum Utility Cost (UC):

$$UC = Q.k_q + n_j.k_c + \left(\sum_{j=1}^{j} n_j.Q_{HE,cl}.\tau\right).k_q$$

With equality constraints:

$$Q = \left(\sum_{j=1}^{j}\int_0^{t_e} Q_{HE,cl}\,.dt\right) - \left(\sum_{j=1}^{j} Q_{rec,j}\right)$$

$$Q_{rec} = n_j.\left(\int_0^{t_{clean}} U_f.A.\Delta T_{LM}.dt + Q_{HE,cl}.\tau\right)$$

$$t_{clean} = \frac{t_e}{n_j}$$

$$Q \geq 0;\ Q_{rec} \geq 0$$

where $Q_{HE,cl}$ is the heat load for each exchanger (j = 1,2,...) and τ is the duration of the cleaning. t_e (days) is the production time in one period of production. Variables A and ΔT_{LM} considered constant during the production process. k_p and k_c respectively is a factor in utility costs ($/BTU.hr^{-1}) which is constant and cleaning fee ($/each cleaning action) in each heat exchanger.

DISCUSSION

For the implementation of this model, a case study is used as a model as shown in Table 1.

TABLE 1. PROCESS DATA.

Type	Material	T_{in} (°F)	T_{out} (°F)	$m.c_p$ (Btu/hr.°F)
H_1	Iso-Butane	260	160	30,000
H_2	Toluene	250	130	15,000
C_1	Benzene	120	235	20,000
C_2	Butane	180	240	40,000

After the calculation the characteristic equation obtained as given in Table 2 [1].

TABLE 2. CHARACTERISTIC FUNCTION DATA.

Device No.	Characteristic function (U_f)
1	$U_f = 50.17593.e^{-0.001355t}$
2	$U_f = 34.985682.e^{-0.001t}$
3	$U_f = 56.42526.e^{-0.00149t}$
4	$U_f = 48.334566.e^{-0.001314t}$

Heat integration was applied for the case study above, in order to determine the number of heat exchanger for energy recovery and minimum utility requirements.

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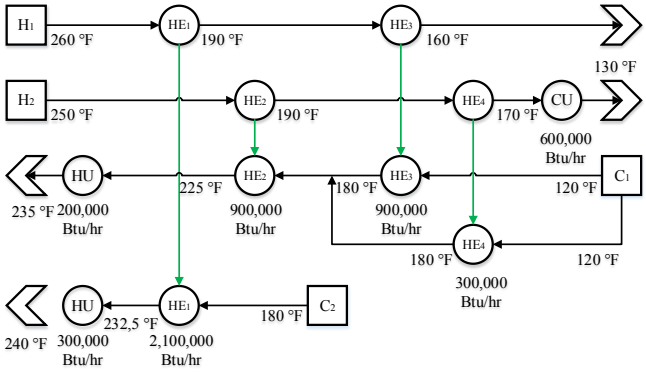

Figure 1. Heat integration depicted in the diagram grid.

The results of the heat integration was known to be 4 units (see Figure 1). Then by setting the variable k_q = \$ 0.005/(BTU.hr^{-1}), variable k_c = \$ 10,000/cleaning action and τ (cleaning time) for 3 days, we get the following results as given in Table 2.

TABLE 2. OPTIMUM SCHEDULING RESULTS.

Device No.	Cleaning action (n_j)	Total cost (US$)
1	3	392,998.8
2	3	
3	4	
4	2	

So if one plots between Q_{rec} versus time (days) the results are shown in Figure 2.

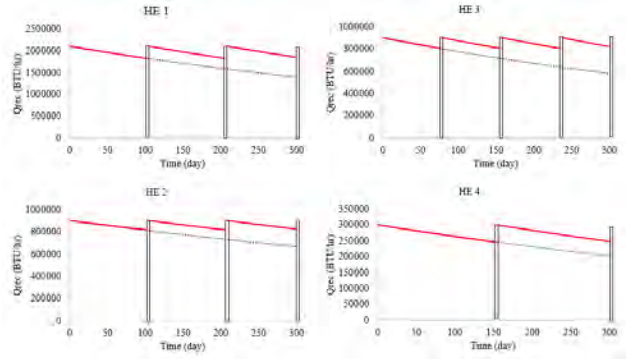

Figure 2. graph representation for cleaning action.

Line empty box indicates an interval during cleaning, which at that period of the heat exchanger in the off condition and all the energy needs for the period was replaced with utilities from the outside. If viewed from the cleaning time based on the performance limit of the heat exchanger, one gets the following results, see Table 3.

TABLE 3. LIMIT OF THE PERFORMANCE HEAT EXCHANGER BEFORE BEING CLEANED.

Device No.	Q_{rec} (%)
1	87.32392
2	90.48379
3	89.41766
4	82.10674

CONCLUSION

From the results above, it can be concluded that the scheduling of the cleaning cycle of the heat exchangers is strongly influenced by the duration and frequency of cleaning. During the cleaning time, the utility needs to rise, proportionally with the needs of the energy to be recovered due to the operation of the exchanger.

ACKNOWLEDGEMENTS

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REFERENCES

[1] Licindo, D., Renanto H., and Juwari P.S., *Optimization On Scheduling For Cleaning Heat Exchanger In The Heat Exchanger Networks*, PRES'15 (18th Conference Process Integration, Modelling and Optimisation for Energy Saving and Pollution Reduction) Kuching, Sarawak, Malaysia. 2015, In Press.

[2] M Georgiadis, M. C., Papageorgiou, L. G., Macchietto, S., "Optimal cleaning Scheduling In Heat Exchanger Networks Under Fouling", *Elsevier Computers and Chemical Engineering Supplement*, 1999, pp. S203-S206.

[3] Ishiyama, E. M., Paterson, W. R., Wilson, D. I. (2011b). "Exploration of alternative models for the aging of fouling deposits". *AIChE Journal*. Vol. 57, No. 11, hal. 3199-3209.

[4] Markowski, M. and Krzysztof Urbaniec. (2004), "Optimal Cleaning Schedule for heat exchangers in a heat exchanger network", *Applied Thermal Engineering*, Vol. 25, hal. 1019-1032.

QM/MM dynamics of Proton Transport in Chitosan/Phosphotungstic Acid Composite Membrane for Direct Methanol Fuel Cell

Linda Windia Sundarti[1], Lukman Atmaja[1], and I Gusti Made Sanjaya[2]

***Abstract*-The aim of this research is to study proton transport in DMFC using chitosan/phosphotungstic acid (CS/PWA) composite membrane as Proton Exchange Membrane (PEM). Model of proton transport mechanism was proposed in order to investigate the proton transport rationality in CSPWA composite membrane, which is indicated by energy models. QM/MM dynamics method on the basis of CP2K code was used to calculate energy of the models. Results showed that the model of proton transport mechanism produced energy gradient. Interaction model of proton (H^+ ion) and CS/PWA hydrated membrane has minimum QM/MM energy than the other models. The value of QM/MM energy of H^+-CS/PWA hydrated is -312.717135970308 a.u.**

***Index Terms*-Proton transport, QM/MM dynamics, Chitosan, Phosphotungstic acid, Composite membrane, DMFC.**

INTRODUCTION

Proton transport (PT) plays an important role in Direct Methanol Fuel Cell (DMFC). PEM that connects reaction between the cathode and the anode decided the ability of membrane to transport proton from the cathode to the anode. CS is a copolymer of glucosamine and N-acetylglucosamine which has many excellent properties such as biocompability, nontoxicity, chemical and thermal stability, thus it has been widely studied as a promising membrane materials. PWA ($H_3PW_{12}O_{40}$), possess a unique discrete ionic structure and exhibits extremely high proton conductivity. Experimental study reported that modification of biopolymer chitosan (CS) and complex agent phosphotungstic acid (PWA) formed composite membrane which produces proton conductivity of membrane 2.4 x 10^{-2} S cm^{-1} at temperature 80°C [1].

In theoretical study, proton (H^+) react to the surrounding water form hydroinum ion (H_3O^+), then the hydronium ion transport to the Nafion polymer membrane by hopping mechanism [2]. Interaction detail between chitosan and phosphotungstic acid in composite membrane not reported yet theoretically. However, despite extensive study, the molecular-level details of membrane morphology, proton hopping, and small molecule transport are poorly understood, because the dynamical processes at subnanometer and subnanosecond scales are not readily accessible to experiments [2]. Therefore, studies of rationality proton transfer in membrane have been paid more attention for both experimental and theoretical research.

In this paper, we investigate energy QM/MM of the proton transport model in mechanism of CS/PWA composite membrane. The following QM/MM dynamics are carried with CP2K code, which provides a general framework for DFT using a mixed Guassian and plane waves approach and classical pair and many-body potentials [3]. CP2K code is a open source molecular dynamics program to perform atomistic and molecular simulations.

MATERIAL AND METHODS

The model used to QM/MM calculation are fragment of one molecule chitosane and phosphotungstic acid, two molecule water, one hydronium ion (H_3O^+) and one proton (H^+). The models are shown in Figure 1. The primary software that used to calculate QM/MM method is CP2K package that consist of CP2K code and data (version 2.2.426-6). Additional softwares used are Avogadro (version 1.0.3-5), Bluefish Editor (version 2.2.2-1) and Visual Molecular Dynamics (VMD) version 1.9.1. All software are open source that ran in Linux operation system. The type of Linux is Ubuntu 12.04 LTS (Precise Pangolin) 64 bit. The hardware used is a Notebook that has specification i.e. Random Acces Memory 4GB DDR3, inte core i5, and NVidia GeForce 720M.

Preparation for calculate QM/MM started by build model using Avogadro. Avogadro software also used to minimize the structure model to remove bad contacts and reach closet local minima, that process called minimize energy. The next step, optimize geometry models using CP2K with run type job GEO_OPT. The last step,

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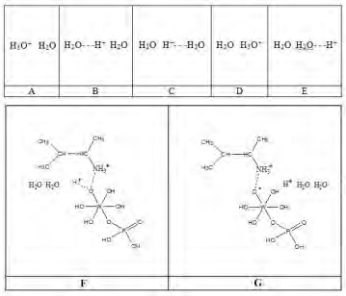

Figure 1. The 2D Model of proton transport mechanism in CS/PWA composite membrane.

simulate QM/MM method to get excited-state dynamic by using CP2K code. The QM/MM parameter that used i.e. ensemble NVT (number of atom, volume dan temperature) constant, temperature 298 K, cell volume 12 x 12 x 12 Å, canonical through velocity rescaling (CSVR) thermostate type, Goedecker- Teter-Hutter (GTH) pseudopotential, Becke-Lee-Yang-Parr (BLYP) functional, GTH and GPW (Gaussian and Plane Wave) basis set, and boundary condition 0.5 femtosecond. The result of QM/MM method visualized by VMD software.

RESULTS AND DISCUSSION

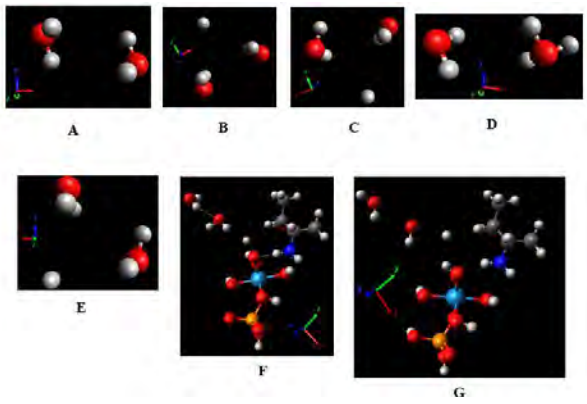

Figure 2. The 3D model of proton transport mechanism in CS/PWA composite membrane (red: oxygen, white: hydrogen, grey: carbon, deep blue: nitrogen, sea blue: tungsten, and orange: phosphate).

The modeling mechanism of proton transport followed step in Figure 1. 3D model have been build and minimized by Avogadro are shown in Figure 2. In that case conjugate base from amina protoned (NH_3^+) from chitosane dan ion WO^- from phosphotungstic acid are defined as quantum box, which will be simulated with quantum mechanics (QM), and the others with molecular mechanics (MM). It should be pointed out that water are excluded out of the QM region.Model A consist of one hydronium ion and one molecule water, B consist of propagation loss of H^+ ion from the ion hydronium and one molecule water, C consist of one molecule water and interaction of H^+ and water, D consist of one molecule water and one hydronium ion, E consist of one molecule water and interaction of H^+ and water, F consist of two molecule water and interaction of H^+-monomer CS/PWA, and G consist of monomer CS/PWA that has loss H^+ and two molecule water.

Figure 3 shown that position of H+ ion, hydronium ion, molecule water, and interaction of H+ and fragment CS/PWA give different interaction and resulted different QM/MM energy. Model A to F give energy gradient form high to low energy, its mean that dynamics of proton transport will be rationality occur from high energy to low energy. Model F has minimum QM/MM energy than the other models. It's mean that interaction of CS/PWA composite membrane and proton rationality occur and the proton interact electrostatically. The value of QM/MM energy of H+-CS/PWA hydrated is -312.717135970308 a.u. Model G give energy higher than F, its about 0.010248465 a.u, because of the model stability is H+ ion interact to atom O of W-O bond in PWA fragment (model F). Model G shown that proton back interact to the free water.

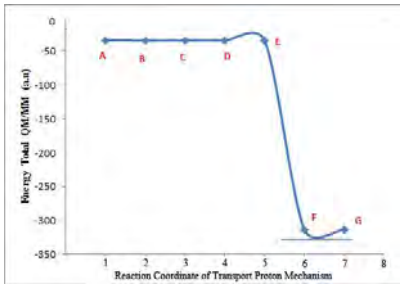

Figure 3. Graphic of QM/MM total energy in different model

CONCLUSION

The result of this research are model of proton transport mechanism in CSPWA composite membrane rationality occur. The interaction of proton in form H+ ion and CS/PWA membrane has lowest QMMM energy of the other model. The QMMM energy of H^+-CS/PWA hydrated is -312.717135970308 a.u., its energy shown that this model most stable configuration structure.

REFERENCES

[1] Cui, Z., Liu, C., Lu, T., dan Xing, W.,"Polyelectrolyte complexes of chitosan and phospotungstic acid as proton-conducting membranes for direct methanol fuel cells". Journal of Power Sources, 167, 94-99, 2007.

[2] Devanathan, R., Idupulapati, N., Bear, M.D., Mundy, C.J., dan Dupuis, M., "Ab Initio Molecular Dynamics Simulation of Proton Hopping in a Model Polymer Membrane", *Journal of Physial Chemistry*, 117, 16522−16529, 2013.

[3] Zhang, G. and Xie, S., "Temperature and Electric Field Effect on Proton Transfer in Adenine-thymine", *Bull. Korean Chem. Soc*., Vol. 35, No. 12, 2014.

Enhancement Concentration of Bioethanol Through Packed Sieve Tray Distillation

Fadlilatul Taufany[1], I G. N. Pranata Adi Putra[1], and Rydho Jalu Nuringtyas[1]

Abstract – Bioethanol is one of alternative renewable energy that can be produced by distillation process. Distillation itself is a method of separation and purification that most widely used in the chemical industry. Nowadays, distillation equipment that is commonly used in the industry is sieve tray tower due to its affordable in cost and simplicity in design. Its performance can be improved by the addition of packing on the tray can improve efficiency. This study aims to evaluate the performance of the developed steel wool packing in sieve tray distillation with regards to the bioethanol purity. Our results showed that the addition of the developed packing in each tray significantly increased the concentration of ethanol up to 99.5%.

Index Terms – Bioethanol, Distillation, Steel wool packing, Packed Sieve Tray

INTRODUCTION

Distillation is a method of separation and purification that most widely used in the chemical industry. There are various type of trays, such as sieve tray, valve tray and bubble cap tray. It is widely accepted that sieve tray is best choice technology due to its affordable cost and simplicity in design. Recently it was found that the addition of packing on one singular tray can improve the tray efficiency.

Gorak and Olujić [1] stated that the tray with smaller holes have a better distribution between the vapor-liquid, reduce weeping, and improve the efficiency of the resulting bubble tray for small to large interfacial area. Chen *et al*. [2] have researched the performance of sieve tray combined with mesh packing, and has concluded that the tray efficiency increase between 5 to 40% with the addition of 30 mm mesh packing on the tray, and packed sieve tray having a low entrainment and high pressure drop. Later, Baeyens *et al*. [3] conducted a study which stated that the efficiency of a sieve tray was significantly increased by the addition of mesh packing. They suggested that the addition of packing increased the interfacial area and a vapor-liquid contact.

This study develops a steel wool packing, adds it on each trays distillation column, and evaluates its effects on the purity of bioethanol product.

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MATERIALS AND METHODS

I. Preparation of Synthetic Feed

Feed that was used for the distillation process in this study is a synthetic feed, which is composed of a mixture of ethanol (6% v/v), glycerin (0.07% v/v), acetate acid (0.0236% v/v), amyl alcohol (0.015% v/v), acetone (0.015% v/v) and water (93.876% v/v) in 13 L of total solution. This composition is conditioned in such a way to mimic the product from the molasses fermentation.

II. Distillation Process

The distillation process in this study is employing multi-component batch distillation method, by specifically using a sieve tray column that is modified by the addition of packing. This particular modified sieve tray column is known as packed sieve tray distillation column. Here 16 trays are used as a model in this packed sieve tray distillation column. A developed steel wool type packing that is currently used in this study, is varied by its height, *i.e*. 3 and 5 cm. In the distillation process, the procedure is initiated by pouring 13 L of that of prepared synthetic feed into the distillation column at atmospheric condition, with maintained reflux ratio of 3. The temperature at the boiler was kept at 100 °C. During the distillation process that approximately is lasted up to 1 hour the purity of the resulted ethanol was monitored by alcoholmeter. The corresponding pressure drop in this packed sieve tray column was also monitored.

RESULT AND DISCUSSION

Fig. 1 shows that the addition of steel wool packing on each 16 trays, significantly increased the purity of ethanol. To be precise, the purity of ethanol was improved from 94.6% to 99.5%, as compared to that of without packing.

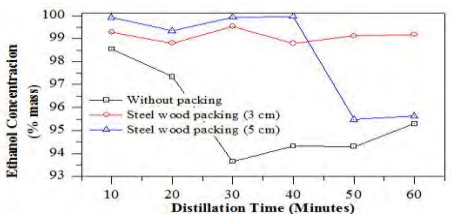

Figure 1. The comparison of the purity of ethanol from the sive tray distillation column that are using steel wool packing and without using that of packing.

The addition of packing in each 16 trays was found to increase the ethanol concentration product. This can be explained by the fact that the contact between the liquid and the vapor is improved, thus causing better mass transfer between liquid and vapor in the sieve tray distillation system. When the contact between the vapors occurs, the water content will be retained on the packing. However, the content of ethanol in the vapor will pass and condensed to distillate. So that the condensed distillate ethanol concentration would be higher [4].

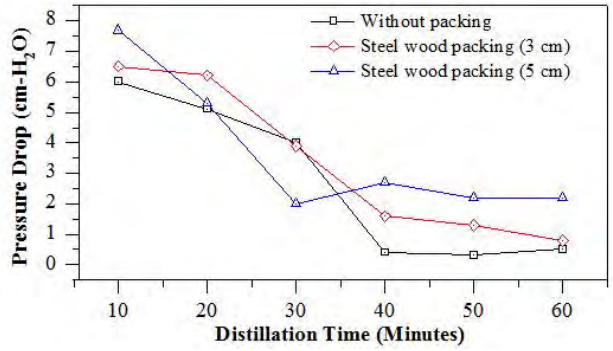

Figure 2. The comparison of the resulting pressure drop in a sive tray distillation column that are using steel wool packing and without using that of packing.

From Figure 2, it can be seen that with the addition of packing on trays, can increase the pressure drop. To be precise, the higher packing system will increase the pressure drop in a sieve tray distillation column. The increasing of total pressure drop in the column due to the growing interfacial area, so that the vapor columns that rise to the top will be in contact with the packing which then becomes liquid and drops down [5].

CONCLUSION

This study showed that the potential of using a developed steel wool packing that is added on each tray to produce bioethanol via a sieve tray distillation process. We found that bioethanol with purity of 99.5% can be produced in this study.

REFERENCES

[1] Gorak, A. & Olujić, Ž. (2014). *Distillation: Equipment and Processes*. Oxford, UK: Academic Press.

[2] Chen, W. C., Sheng, C. T., Liu, Y. C. Chen, W. J., Huang, W. L., Chang, S. H., Chang, W. C. (2014). Optimizing the efficiency of anhydrous ethanol purification via regenerable molecular sieve. *Applied Energy*, *135*, 483-489.

[3] Jan Baeyens, J., Kang, Q., Appels, L., Dewil, R., Yongqin Lv, Y., Tan, T. (2015). Challenges and opportunities in improving the production ofbio-ethanol. *Progress in Energy and Combustion Science*, *47*, 60-88.

[4] Kumar, S., Singh, N., Ram Prasad, R. (2010). Anhydrous ethanol: A renewable source of energy. *Renewable and Sustainable Energy Reviews*, *14*, 1830-1844.

[5] Wang, Y., Gong, C., Sun., J., Gao, H., Zheng, S., Xu, S. (2010). Separation of Ethanol/Water Azeotrope using Compound Starch-based Adsorbent. Bioresource Technology, *101* (15), 6170-6176.

Impact of Biogas Purification System on Generated Power in Gas Engine Generator

Fadlilatul Taufany[1], Bobby Rama Jaya R[1], and Ardhiya[1]

***Abstract* - One of alternative renewable energy is biogas, which is the end product of anaerobic degradation by methanogens bacteria. In general, biogas contains CH_4, CO_2, H_2S and H_2O. Biogas is potential in a power generation but must be purified to meet the desired specifications by removing its impurities, i.e. CO_2, H_2S and H_2O. This research aims to perform a feasibility study for the biogas purification with respect to CO_2 and H_2S removal by utilizing various alkalines and their respective salts (NaOH, KOH, $Ca(OH)_2$, Na_2CO_3, K_2CO_3, $CaCO_3$) as the absorbent. Additionally, its impacts on generated power are also being studied. The results indicate that NaOH was the optimum absorbent in perspective of technical and economical aspects.**

***Index Terms* – Alkalines and salts, Amine, Biogas, Power generation, Purification**

INTRODUCTION

In respect to the shortage of the fossil fuels, there abundant reports on developing various renewable energy sources, such as biofuel, fuel cells, solar cells, biogas, etc. Among these renewable energy sources, biogas is considered as a promising option, as it can be produced from various sources of organic wastes. Biogas itself is the end product of anaerobic degradation of biomass by methanogens bacteria. In general, biogas is composed of majority of hydrocarbon of CH_4, acid gases of CO_2 and H_2S, and minor saturated H_2O, with their respective composition of 55 - 75%, 25 - 45%, 0.1 - 0.5%, and H_2O is the rest. With such a high CH_4 content, biogas is thus potential to be used as energy source for combustion in gas power generation [4]. In the application of biogas in power plant, biogas therefore needs to be purified to meet the desired specification, namely biogas methane content $\geq$ 75% (GPSA Standards for pipeline gas) by removing its impurities, namely CO_2, H_2S and H_2O.

Gas with higher methane content will give a higher heating value than that of gas with lower methane content. This in effect will impact on the amount of the generated power from the gas engine generator [3]. There are several methods on acid gas removal that are generally being used, *i.e.* solvent absorption, solid adsorption, membrane, direct conversion and cryogenic fractionation. Solvent absorption has three methods which are chemical, physics and hybrid method. Chemical solvent absorption is divided into two ways, which are using amine solvent and alkalines with its respective salts solvent [2].

This research aims to evaluate the chemical absorption method that is using alkalines with its respective salts solvent (NaOH, KOH, $Ca(OH)_2$, Na_2CO_3, K_2CO_3, $CaCO_3$)[1], and its impact on generated power from gas generator.

MATERIALS AND METHODS

Biogas was produced from a pilot plant scale of anaerobic digester reactor. Various absorbents being studied here are base compounds (*i.e.* NaOH, KOH, $Ca(OH)_2$) and their respective salts (*i.e.* Na_2CO_3, K_2CO_3, and $CaCO_3$).

I. Biogas and absorbent preparation

Biogas is produced from 5000 L anaerobic digester. The feed is composed of 9 L molasses and 100 gr urea, which is then dissolved in 1200 L water and HRT 14 days. Biogas is then collected in gas holder at a pressure of 55 cm-H_2O (1.055 atm). Meanwhile, the absorbent solution is prepared by diluting a specific amount of absorbent powder in an aquadest to form a 0.1 N concentration.

II. Absorption Process

Raw (untreated) biogas is subjected through a packed tower of using Raschig ring packing, from the bottom of the tower, while for that of absorbent solvent is subjected through the column from top of the tower, with a gas:liquid (G:L) ratio of 25:1.

III. Power Generation

The purified biogas is then compressed into a biogas tank with pressure approximately 8 barg. Compressed biogas tank is then fed to gas engine generator with suction pressure of 5 barg. Gas generator generates of approximately 400 watt electricity.[5]

RESULT AND DISCUSSION

I. % Recovery of CO_2

It is evident from Fig. 1 that the NaOH absorbent has the highest % recovery of CO_2, which indicating that this

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absorbent is the most reactive one towards the reaction with CO_2 gas.

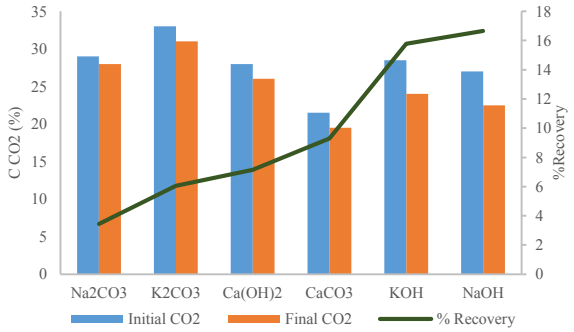

Figure 1. % Recovery of CO_2 from various absorbents.

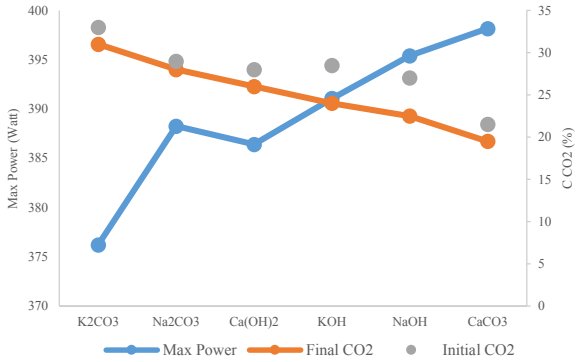

Figure 2. Max Power vs CO_2 Content.

II. Power Generated

It is evident from Fig. 2 that the decrease of CO_2 content inversely proportional with increase of maximum power generated. This means when the impurities of CO_2 acid gas is being removed from the biogas, the burnable CH_4 gas fuel is increased, thus give an improvement in generated electricity power. This can be easily explained from the perspective of the biogas heating value. To be precise, once the unburnt CO_2 gas was removed from the biogas, we will definitely experience the increase in its heating value, which in return gives an increase in generated power. In a detailed inspection in Fig. 2, NaOH and $CaCO_3$ gave a higher generated power.

III. Unit Production Cost

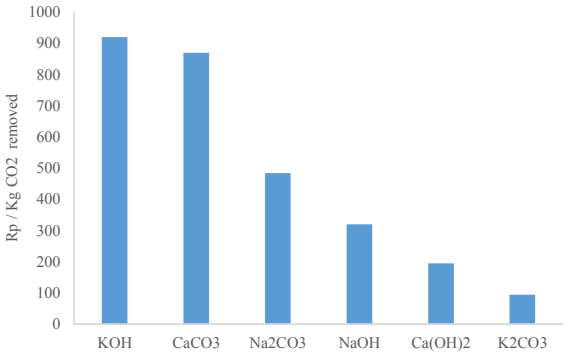

Figure 3. Unit Processing Cost

From the Fig. 3, it is clearly found that the decrease in unit processing cost of CO_2 removal is following a series of K_2CO_3, $Ca(OH)_2$, NaOH, Na_2CO_3, $CaCo_3$, and KOH. In combination from both technical and economical perspectives, we found NaOH is the optimum option

CONCLUSION

From the feasibility studies that have been conducted, the NaOH solvent was found to be an optimum absorbent in perspective of technical (% recovery and maximum power generated) and economic (unit production cost).

REFERENCES

[1] Herawati, Dewi. A., Wibawa, Arif. D., and Fitriyawati., Utya., The Impact of Solvent of Absorbtion CO2 from Biogas Vinasse, 2014.

[2] Parrish, William. R., and Kidnay, Arthur. J., Fundamentals of Natural Gas Processing, Taylor & Francis Group, London, 2006.

[3] Somehsaraei, H. N., Majoumerd, M. M., Breuhaus, P., and Assadi, M., Performance Analysis of a Biogas – Fueled Micro Gas Turbine Using a Validated Thermodynamic Model. Applied Thermal Engineering, 66, 181 – 190, 2013.

[4] Kang, Do Won., Kim, Tong Seop., Hur, Kwang Beom., and Park, Jung Keuk. The Effect of Firing Biogas on the Performance and Operating Charateristics of Simple and Recuperative Cycle Gas Turbine Combined Heat and Power Systems, Applied Energy, 93, 215 – 228, 2011.

[5] Himabindu, M. and Ravikrishna, R. V., Performance Assessment of a small Biogas – Fuelled Power Generator Prototype, Scientific & Industrial Research Vol. 73, 781 – 785, 2013.

Esterification of Waste Cooking Oil Using Heterogeneous Catalyst: An Experiment for The Catalytic Chemistry Laboratory

Nungky Purwasusanti[1] and Ratna Ediati[1]

Abstract-The basic concept of the use of catalysts can be studied in the course of chemical catalysts. The use of heterogeneous catalysts offers many advantages, such as: the catalyst can be easily separated from the reaction mixture without the use of solvent. Chemical catalyst can be studied through experiments of esterification reaction of waste cooking oil with methanol using heterogeneous catalyst in the process of making biodiesel. Esterification results showed that the highest conversion (83%) was obtained by metakaolin catalyst at a reaction temperature of 160 °C for 2 hours at oil to methanol ratio of 1:30.

Index Terms-Chemical Catalyst, Esterification, and Metakaolin.

INTRODUCTION

One of the problems that exist in Indonesia is the increasing fuel needs in line with the population growth. Alternative fuel that can be introduced to students is biodiesel. Educators can introduce the concept of biodiesel production and provide opportunities for students to make their own biodiesel using analytic approach. The ideas of learning covered in the preparation of biodiesel, include biology, physics, economics, and chemistry. Aspects of biodiesel production in terms of economics is the use of alternative fuels more efficient, while in terms of chemistry is acid-base titration, esterification and transesteriication reactions, as well as catalytic reaction (Bladt et al., 2011).

The basic concept of the use of catalysts can be studied in the course of Chemical Catalysts. The use of heterogeneous catalysts offer many advantages, namely: the catalyst can be easily separated from the reaction mixture without the use of solvents, easily regenerated, not toxic, less expensive, and more environmentally friendly (Perego and Villa., 1997). Heterogeneous catalysts derived from natural materials that are readily available in the market is kaolin. Prior to use, the kaolin should be calcined at 800°C for 10 hours.

MATERIAL AND METHOD

I. Materials

The materials used in this study include: waste cooking oil, Kaolin, sulfuric acid (Merck, 98%), sodium hydroxide (Merck, 99%), demineralized water, methanol (Merck, 98%), phenolphtalein indicator, isopropanol (Merck, 99.5%), waste cooking oil.

II. Preparation of Catalyst

2 g of kaolin was calcined at 800 °C for 10 hours, with a heating rate of 10 °C per minute, to obtain metakaolin (Ortiz et. al., 2011). The kaolin and metakaoiln were then characterized using a PANalytical X'PERT PRO MPD (PW 3040/60) diffractometer with CuKα (40kV and 30 mA) radiation at °5<2θ<50° intervals.

III. Esterification of Waste Cooking Oils

The metakaolin was dried at 120 °C for 1 hour prior to use. 10 g of waste cooking oil was heated at a temperature of 60°C for 30 minutes, followed by addition of methanol and 3% of metakaolin catalyst (0.3 g). The ratios of oil to methanol were varied as follows: 1:20, 1:25, 1:30, and 1:35. The mixture was then refluxed at 160 °C for 2 hours. The reaction mixture was left to cool to room temperature, then poured in to a separator funnel and left to settle for about 10 minutes. The top layers, should be the biodiesel dissolved in methanol, was washed with n-hexane and heated at 60 °C to evaporate the solvent. The free fatty acid (FFA) content in the initial waste oil and in the reaction product were analyzed by titration method according to AOCS (*American Oil Chemistry Society*). The FFA content was calculated using the following formula:

$$\text{FFA (\%)} = \frac{V\ NaOH\ x\ M\ NaOH\ x\ 25{,}6}{g\ sample}$$

RESULTS AND DISCUSSION

I. XRD Analysis

The diffraction patterns of kaolin and metakaolin are shown in Figure 1. Peaks characteristics of kaolin were observed at 2θ of 12 and 25°, respectively. The kaolinite peaks disappear after calcination process, replaced by a wide band at 2θ of 21 and 27° and amorphous SiO_2 (Nascimento et al., 2011). Al units are more susceptible to Al^{3+} and the observed increase in the amorphous phase.

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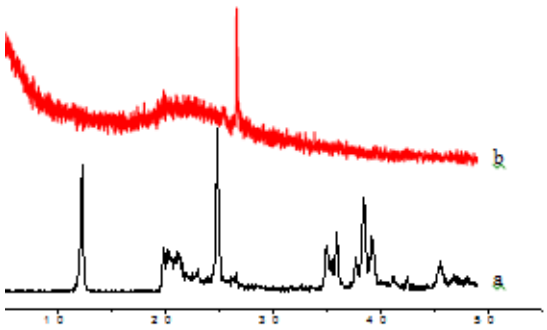

Figure 1. Diffractograms of kaolin (a), metakaolin (b).

II. Esterification Reaction

The oil to methanol molar ratio is one of the most important parameters affecting FFA conversion. Theoretically, the esterification reaction of oil requires 1 mol of oil per mole of methanol. Since this reaction is reversible, an excess of methanol shifts the equilibrium towards ester formation. Results of esterification reaction in the form of conversion of FFA at various ratios of oil to methanol are shown in Figure 2. As is shown in Figure 2, the conversion was increased with the increase in the ratio of oil to methanol up to 1:30. Esterification results showed that the highest conversion (83%) was obtained by metakaolin catalyst at a reaction temperature of 160 °C for 2 hours at oil to methanol ratio of 1:30. Further increase in the amount methanol, lead to the increasing of polarity of entire reaction system, finally affect the reaction rate and decrease the FFA conversion (Lianhua et.al., 2010). The increasing number of alcohol molecules around the catalyst could facilitate the removal of water molecules from the surface of the catalyst, increasing their catalytic activity. Furthermore, more excess of methanol cause the separation of the methyl ester phase was getting longer, thereby reducing the yield of biodiesel (Nascimento et al., 2011).

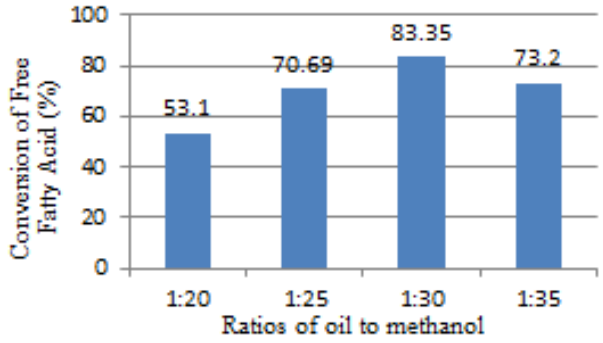

Figure 2. Conversion of Free Fatty Acid at Various Ratios of Oil to Methanol.

CONLUSSION

Esterification results showed that the highest conversion (83%) was obtained by metakaolin catalyst at a reaction temperature of 160 °C for 2 hours at oil to methanol ratio of 1:30.

ACKNOWLEGMENT

We gratefully acknowledge the research fellow team for useful discussion and the Laboratory of Materials Chemistry and Energy, Department of Chemistry, Institut Teknologi Sepuluh Nopember (ITS), Surabaya.

REFERENCES

[1] Bladt, D., Murray, S., Gitch, B., Trout, H., Liberko, C. (2011),"Acid-Catalyzed Preparation of Biodiesel from Waste Vegetable Oil: An Experiment for the Undergraduate Organic Chemistry Laboratory", *Chemical Education*, vol. 88, no. 2, pp. 201-203.

[2] Lianhua L., Pengmey L., Wen L., Zhongming W., Zhenhong Y. (2010) "Esterification of High FFA Tung Oil with Solid Acid Catalyst in Fixed Bed Reactor", *Biomass and Bioenergy*, vol. 34, pp. 496-499.

[3] Nascimento do, S, Luis, Aldriano., Angelica, S.R., Costa da, E.F, Carlos., Zamain, J.R., Filho, Rocha da, N.G. (2011b) "Comparative Study Between Catalyst for Esterification Pepared from Kaolins", *Applied Clay Science*, vol. 51, pp. 267-273.

[4] Ortiz, R.J., Valtierra, M.J., Rosales, M. (2011), "Used Frying Oil for Biodiesel Production Over Kaolinite as Catalyst", *World Academy of Science, Engineering and Technology*, vol. 5, pp. 764-767.

[5] Perego, C. dan Villa, P. (1997), "Catalyst Preparation Methods", *Catalysis Today*, vol. 34, pp. 281-305.

Simulation of Solar-Assisted Single Stage Absorbtion Chiller as Ice Maker Based on MATLAB

Ridho Hantoro[1] and Dwi Ganef Janesa[1]

INTRODUCTION

In this research, the system is described in the two-dimensional form to simplify the completion and modeling. There are various kinds of components, among others: evaporator, condenser, solution heat exchanger (SHX), absorber, generator (including solar collector), pumps, and expansion valve. There is a schema of solar-assisted single stage absorption chiller that used:

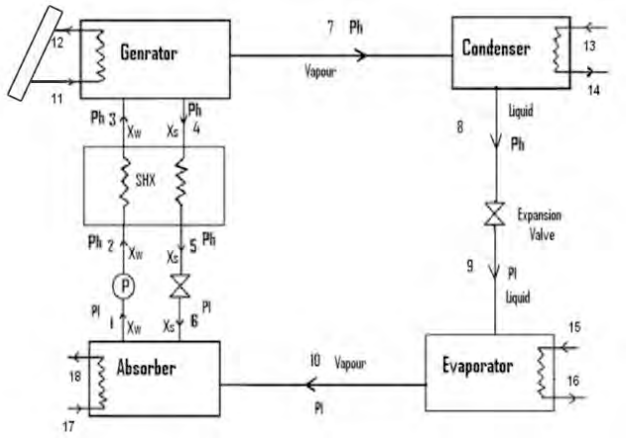

Figure 1. Schema of solar-assisted single stage absorption chiller.

Fluid from state 1 will get pressure by the pump, then passed to Solution Heat Exchanger (SHX) to get heat from the generator output (state 4). SHX Output (state 3) entering generator which will then absorb the heat from the solar collector. Generator output is divided into two parts, state 4 (going through SHX) and state 7 which will enter the condenser. Fluid on the state 8 which has been condensed and turned into a liquid phase, flows through the expansion valve to absorb heat from the state 15. Ammonia at state 10 go through to the absorber, to make the process of absorption and add to the composition of the ammonia in the ammonia-water mixture used in the first state.

Simulation with MATLAB-based program has been conducted to determine the value of the COP system, the mass of ice that forms, and solar collector area needed by the system. Variations in the composition of the ammonia in strong solution (XS), the composition of ammonia in weak solution (XW), and the refrigerant mass flow rate ($\dot{m}_{ref}$) has performed. Variation of XS, XW, and $\dot{m}_{ref}$ cause changes in the values of property systems, such as : enthalpy, temperature and mass flow rate. Changes in the values of these peroperty cause changes in the value of the heat flow rate on the components of the system, Coefficient of Performance (COP), solar collector area (ASC) needed by system, and the mass of ice produced.

In XS variation, it was found that the composition can be used is in the range 0.4 to 0.95. The variation using reference value of XW by 0.3. The range of 0.4 to 0.95 is the conclusion of the mass flow rate of data retrieval and flow rate generator heat generated from the program. Based on Figure 5, note that the value of the flow rate is negative in the range of 0.05 to 0.25, whereas the mass flow rate value XS 0.3 is infinite. This is due to factors divisor of calculation used in the program is 0, so the calculation result reaches infinite. Based on Figure 10, it is known that $\dot{Q}_g$ is negative at XS 0.35 due to changes in the value of the enthalpy at state 4 becomes -321 kJ/kg.

In XW variation, it was found that the composition can be used is in the range 0.05 to 0.3. The variation using reference value of XS by 0.4. The range of 0.05 to 0.3 is the conclusion of the mass flow rate of data retrieval and flow rate generator heat generated from the program. Based on Figure 8, note that the value of the flow rate is negative in the range of 0.45 to 0.95, whereas the mass flow rate value XS 0.4 infinite worth. This is due to factors divisor of calculation used in the program is 0, so the calculation result reaches infinity. Based on Figure 12, it is known that $\dot{Q}_g$ is negative at XS 0.35 due to changes in the value of the enthalpy at state 3 to -54.52 kJ/kg.

Changes in the mass flow rate of refrigerant in the state 7, 8, 9, and 10 resulted in changes in the rate of heat flow in the generator, condenser, absorber, and evaporator. Changes that occur have a linear pattern, the greater the value of $\dot{m}_{ref}$ increase the value of the heat flow rate on each component. COP value does not change, this is because $\dot{Q}_g$ and $\dot{Q}_e$ vary linearly. At the highest variation $\dot{m}_{ref}$, 0.02 kg/s, solar collector area needed by system reach 4.37 m2. Mass ice produced

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reached 470.44 kg/h. Whereas in most small variations $\dot{m}_{ref}$, 0.001 kg/s, solar collector area needed by system reach 0.22 m2. With the ASC value, mass produced ice reaches 23.52 kg/hour. Based on the data obtained, it is known that to make 1 kg of ice in 1 hour, required 0.05 kW rate of heat flow in the evaporator. Based on the data that has been taken, it is known that the maximum COP values that can be produced on a variety XS, XW, and $\dot{m}_{ref}$ amounted to 1.71. The COP values obtained with the composition of XS 0.4, 0.3 XW composition, and $\dot{m}_{ref}$ in the range of 0.001 to 0.02 kg/s.

Based on the research conducted, it is known that the greater the value $\dot{m}_{ref}$ will increase the value of the rate of heat flow in the generator, condenser, evaporator, and absorber linearly. Composition of ammonia in a strong solution (XS) that can be used is in the range 0.4 to 0.95, while the weak solution (XW) are at 0.05 to 0.3. The best COP values in this research is 1.71 with the XS 0.4 and 0.3 XW. The value of the mass flow rate of refrigerant in the state 7, 8, 9, and 10 do not affect the value of the COP.

REFERENCES

[1] Marc Olivier, Anies G., and Lucas F., Castaing-L J, "Asessing performance and controlling operating conditions of a solar driven absorption chiller using simplified numerical models," presented at J Solar Energy VOL 86 pp 2231-2239. 2012.

[2] Wu Wei, Wang B., Shi W., Li X. "An overview of ammonia based absorption chillers and heat pump". Presented at J Ren and Sus Energy Rev Vol 31 pp 681-707.2014.

[3] Prasartkaew B. "Performance test of a small size LiBr-H_2O abrosption chiller". Presented at J Energy Procedia vol 56. Pp 487-497. 2014.

[4] Silverio R Jesus, Figueiredo J Ricardo. "Steady state simulation of the operation of an evaporative cooled water-amonia absorption scale ice maker with experimental basis". Presented at J ABCM. 2006.

[5] Herold E Keith, et all. "Absorption chillers ad heat pumps". USA : CRC Pres. 1996.

[6] Moran J Michael, Saphiro N Howard. "Fundamentals of Engineering Thermodynamics 5th edition". USA : Wiley. 2006.

[7] Raghuvanshi Satish and Maheswari Govind. "Analysis of Ammonia –Water (NH3-H2O) Vapor Absorption Refrigeration System based on First Law of Thermodynamics". Presented at J IJSER. pp 2229-5518.2011.

[8] Alamdari Soleimani. "Simple functions for predicting the thermodynamic properties of ammonia-water mixture". Presented at IJE Transactions A : Basic Vol 20.2007.

[9] Patek J, Klomfar J. "Simple functions for fast calculations of selected thermodynamic properties of the ammonia-water system". Presented at Int J Refrig Vol 18.1995.

Analysis of Dish Collector Focal Shape in Vertical and Horizontal Direction of Concentrating Solar Power System

Dany Iman Santoso[1] and Djatmiko Ichsani[2]

Abstract – A CSP (Concentrating Solar Power) system must have a receiver to receive solar ray reflection from parabolic dish collector. Based on the receiver installation to the collector, there are two type installation such as parallel to collector (horizontal direction) and perpendicular to collector (vertical direction). In this research not only we compared the receiver orientation but also we varied geometry concentration ratio. The experiment results show that the focal shape diameter elongates 2 mm and surface temperature increases 5-10°C for vertical orientation with greater concentration ratio. However, there is no significant effect to receiver with horizontal orientation. Thermal efficiency was affected by radiation and convection heat loss but for geometry concentration ratio above 100, radiation and convection heat loss gived small impact.

Index Terms – CSP dish, receiver, horizontal orientation, vertical orientation

INTRODUCTION

A secondary concentrator provides more efficiency in the two stage concentrator concept. It gives greater geometry concentration ratio and greater effective intercept factor [1]. Therefore, a receiver that consists arrangement of capilary tubes is placed into the secondary concentrator. Most fabricants placed this receiver in cross section with concentrator but often placed it in edge of concentrator cavity [2]. To keep higher efficiency of a receiver it's not enough just greater geometry concentration ratio, we need to absorb the solar radiation with a selective absorber. Thermal efficiency of a receiver is a function of the geometry concentration ratio and the temperature of receiver [3].

STUDY LITERATURE

Heat input to collector

$$Q_{in} = I_{sun} \times A_c \quad (1)$$

where:

I_{sun} = Sun radiation intensity measured by pyranometer = 840 Wm^{-2}
A_c = Collector area = 4.3 m^2

Heat loss calculation

$$Q_{loss} = Q_{rad} + Q_{conv} = U_L \times A_r \quad (2)$$

where:
U_L = overall heat transfer coefficient
A_r = receiver area = $\frac{\pi}{4} \times (\emptyset_i + t)^2 + \pi \times (\emptyset_i + t) \times p$
t = pipe thickness = 1.8 mm

Receiver efficiency

$$\eta_2 = \frac{Q_{use}}{Q_r} = 1 - \frac{Q_{loss}}{Q_r} \quad (3)$$

Overall efficiency

$$\eta_{th} = \eta_c \times \eta_r = \frac{Q_{loss}}{Q_{in}} \quad (4)$$

EXPERIMENT DESIGN

The receiver diameter varied from 0.25 inch until 1.5 inch with increasing value of 0.25 inch. After receiver diameter have been choosen, pipe length was measured by measuring focal range through surface thermometer. Table 1 shows information about relationship between receiver diameter and focal spot.

TABLE 1. MEASURED FOCAL SHAPE FOR EACH GEOMETRY CONCENTRATION RATIO

Pipe diameter	Focal range	Focal spot
1.50 in	84.5-100.0 cm	92.3 cm
1.25 in	84.7-100.4 cm	92.5 cm
1.00 in	85.0-100.7 cm	92.9 cm
0.75 in	85.2-100.9 cm	93.1 cm
0.50 in	85.3-101.2 cm	93.3 cm
0.25 in	85.5-101.7 cm	93.6 cm

From Table 1 we could conclude that the actual collector focal spot was 93.6 cm. The smallest receiver diameter gived the smallest focal range. From this information (to be reference) we put the horizontal receiver.

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GRAPHICS AND DISCUSSION

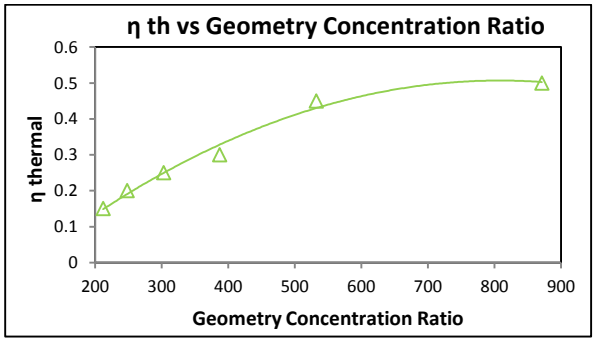

Figure 1. Thermal efficiency graphic.

As shown in Fig. 1 we could conclude thermal efficiency was higher as well as geometry concentration ratio. Fig. 2 shows the effect of heat loss to efficiency.

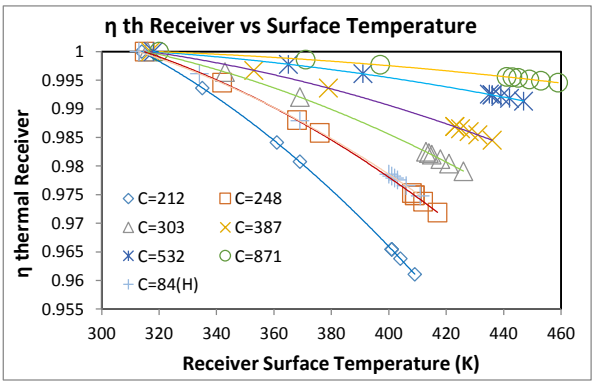

Figure 2. Receiver efficiency graphics.

Described phenomenon from Fig. 2 was the effect by temperature distribution along the surface receiver. We needed to study deeply to know the caracterize of this ditribution in next research by numerical investigation using CFD software.

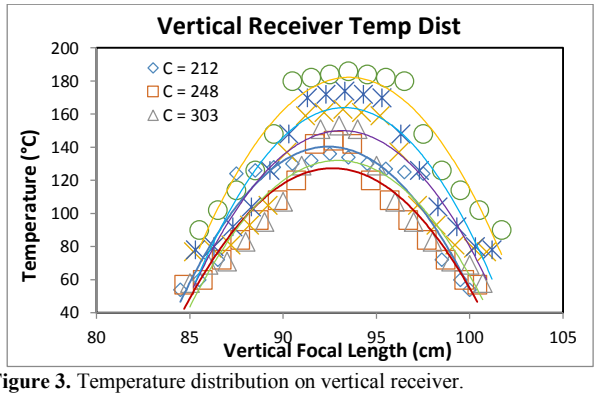

Figure 3. Temperature distribution on vertical receiver.

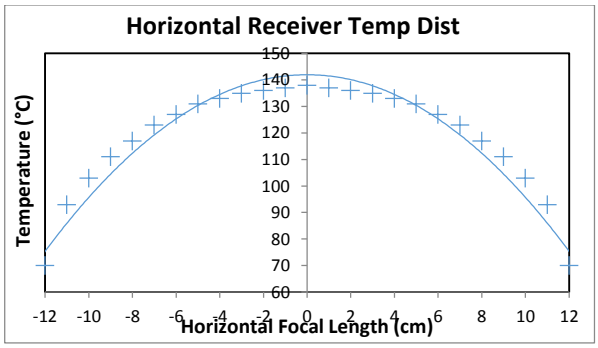

Figure 4. Temperature distribution on horizontal receiver.

CONCLUSIONS

From discussions above we can conclude that:

1) Horizontal receiver has better temperature distribution than vertical receiver.
2) Greater geometry concentration ratio gives greater thermal efficiency.

REFERENCES

[1] J. O'Gallagher and R. Winston, *Performance and Cost Benefits Associated with Nonimaging Secondary Concentrators Used in Point Focus Dish Solar Thermal Applications*, prepared for the U.S. Department of Energy, Colorado, September 1987.

[2] Paul R. Fraser, *Stirling Dish System Performance Prediction Model*, Mechanical Engineering Department thesis, University of Wisconsin, Madison, 2008.

[3] Robert Pitz-Paal et al., *High Temperature Solar Concentrators, in Solar Energy Conversion and Photoenergy Systems*, In Encyclopedia of Life Supports (EOLSS). Developed under the Auspices of the UNESCO. Oxford, UK: Eolss publishers [http://www.eolss.net], 2007.

Esterification of Waste Cooking Oil Using Heterogeneous Catalyst: An Experiment for the Catalytic Chemistry Laboratory

Nungky Purwasusanti[1] and Ratna Ediati[1]

Abstract-.The basic concept of the use of catalysts can be studied in the course of chemical catalysts. The use of heterogeneous catalysts offers many advantages, such as: the catalyst can be easily separated from the reaction mixture without the use of solvent. Chemical catalyst can be studied through experiments of esterification reaction of waste cooking oil with methanol using heterogeneous catalyst in the process of making biodiesel. Esterification results showed that the highest conversion (83%) was obtained by metakaolin catalyst at a reaction temperature of 160 °C for 2 hours at oil to methanol ratio of 1:30.

Index Terms-Chemical Catalyst, Esterification, and Metakaolin.

INTRODUCTION

One of the problems that exist in Indonesia is the increasing fuel needs in line with the population growth. Alternative fuel that can be introduced to students is biodiesel. Educators can introduce the concept of biodiesel production and provide opportunities for students to make their own biodiesel using analytic approach. The ideas of learning covered in the preparation of biodiesel, include biology, physics, economics, and chemistry. Aspects of biodiesel production in terms of economics is the use of alternative fuels more efficient, while in terms of chemistry is acid-base titration, esterification and transesteriication reactions, as well as catalytic reaction (Bladt et al., 2011).

The basic concept of the use of catalysts can be studied in the course of Chemical Catalysts. The use of heterogeneous catalysts offer many advantages, namely: the catalyst can be easily separated from the reaction mixture without the use of solvents, easily regenerated, not toxic, less expensive, and more environmentally friendly (Perego and Villa., 1997). Heterogeneous catalysts derived from natural materials that are readily available in the market is kaolin. Prior to use, the kaolin should be calcined at 800°C for 10 hours.

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MATERIAL AND METHOD

I. Materials

The materials used in this study include: waste cooking oil, Kaolin, sulfuric acid (Merck, 98%), sodium hydroxide (Merck, 99%), demineralized water, methanol (Merck, 98%), phenolphtalein indicator, isopropanol (Merck, 99.5%), waste cooking oil.

II. Preparation of Catalyst

2 g of kaolin was calcined at 800 °C for 10 hours, with a heating rate of 10 °C per minute, to obtain metakaolin (Ortiz et. al., 2011). The kaolin and metakaoiln were then characterized using a PANalytical X'PERT PRO MPD (PW 3040/60) diffractometer with CuKα (40kV and 30 mA) radiation at °5<2θ<50° intervals.

III. Esterification of Waste Cooking Oils

The metakaolin was dried at 120 °C for 1 hour prior to use. 10 g of waste cooking oil was heated at a temperature of 60°C for 30 minutes, followed by addition of methanol and 3% of metakaolin catalyst (0.3 g). The ratios of oil to methanol were varied as follows: 1:20, 1:25, 1:30, and 1:35. The mixture was then refluxed at 160 °C for 2 hours. The reaction mixture was left to cool to room temperature, then poured in to a separator funnel and left to settle for about 10 minutes. The top layers, should be the biodiesel dissolved in methanol, was washed with n-hexane and heated at 60 °C to evaporate the solvent. The free fatty acid (FFA) content in the initial waste oil and in the reaction product were analyzed by titration method according to AOCS (*American Oil Chemistry Society*). The FFA content was calculated using the following formula:

$$\text{FFA (\%)} = \frac{V\ NaOH\ x\ M\ NaOH\ x\ 25{,}6}{g\ sample}$$

RESULTS AND DISCUSSION

I. XRD Analysis

The diffraction patterns of kaolin and metakaolin are shown in Figure 1. Peaks characteristics of kaolin were observed at 2θ of 12 and 25°, respectively. The kaolinite peaks disappear after calcination process, replaced by a wide band at 2θ of 21 and 27° and amorphous SiO_2

(Nascimento et al., 2011). Al units are more susceptible to Al^{3+} and the observed increase in the amorphous phase.

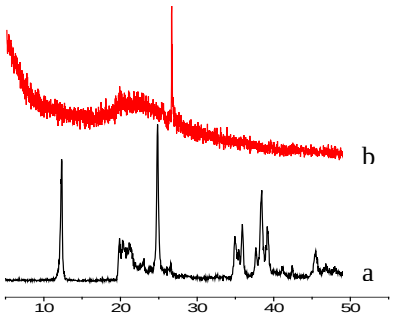

Figure 1. Diffractograms of kaolin (a), metakaolin (b).

II. Esterification Reaction

The oil to methanol molar ratio is one of the most important parameters affecting FFA conversion. Theoretically, the esterification reaction of oil requires 1 mol of oil per mole of methanol. Since this reaction is reversible, an excess of methanol shifts the equilibrium towards ester formation. Results of esterification reaction in the form of conversion of FFA at various ratios of oil to methanol are shown in Figure 2. As is shown in Figure 2, the conversion was increased with the increase in the ratio of oil to methanol up to 1:30. Esterification results showed that the highest conversion (83%) was obtained by metakaolin catalyst at a reaction temperature of 160 °C for 2 hours at oil to methanol ratio of 1:30. Further increase in the amount methanol, lead to the increasing of polarity of entire reaction system, finally affect the reaction rate and decrease the FFA conversion (Lianhua et.al., 2010). The increasing number of alcohol molecules around the catalyst could facilitate the removal of water molecules from the surface of the catalyst, increasing their catalytic activity. Furthermore, more excess of methanol cause the separation of the methyl ester phase was getting longer, thereby reducing the yield of biodiesel (Nascimento et al., 2011).

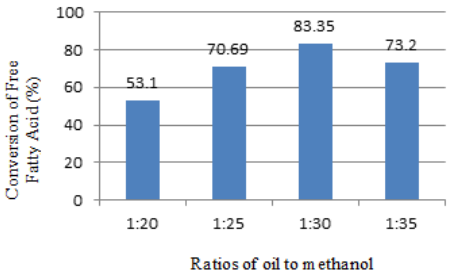

Figure 2. Conversion of Free Fatty Acid at Various Ratios of Oil to Methanol.

CONLUSSION

Esterification results showed that the highest conversion (83%) was obtained by metakaolin catalyst at a reaction temperature of 160 °C for 2 hours at oil to methanol ratio of 1:30.

ACKNOWLEGMENT

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REFERENCES

[1] Bladt, D., Murray, S., Gitch, B., Trout, H., Liberko, C. (2011),"Acid-Catalyzed Preparation of Biodiesel from Waste Vegetable Oil: An Experiment for the Undergraduate Organic Chemistry Laboratory", *Chemical Education*, vol. 88, no. 2, pp. 201-203.

[2] Lianhua L., Pengmey L., Wen L., Zhongming W., Zhenhong Y. (2010) "Esterification of High FFA Tung Oil with Solid Acid Catalyst in Fixed Bed Reactor", *Biomass and Bioenergy*, vol. 34, pp. 496-499.

[3] Nascimento do, S, Luis, Aldriano., Angelica, S.R., Costa da, E.F, Carlos., Zamain, J.R., Filho, Rocha da, N.G. (2011b) "Comparative Study Between Catalyst for Esterification Pepared from Kaolins", *Applied Clay Science*, vol. 51, pp. 267-273.

[4] Ortiz, R.J., Valtierra, M.J., Rosales, M. (2011), "Used Frying Oil for Biodiesel Production Over Kaolinite as Catalyst", *World Academy of Science, Engineering and Technology*, vol. 5, pp. 764-767.

[5] Perego, C. dan Villa, P. (1997), "Catalyst Preparation Methods", *Catalysis Today*, vol. 34, pp. 281-305.

Waste Power Plant Modeling Based Landfill Pretreatment and HCCI (*Homogeneous Charge Compression Ignition)* Generator Engine

Wahyu Hendra W[1] and Gunawan Nugroho[1]

Abstract – Waste management is cruisal problem for major cities in all countries. Technically, MSW (Municipal Solid Waste) biological processes can be converted into LFG (landfill Gas), which can be used as an energy source for electricity generation. LFG utilization as fuel for power generation is also supported by the presence of motor fuel engines based HCCI (Homogeneous Charge Compression Ignition). To ensure the successful adoption of waste power plan based HCCI engine-generator, in the form of mathematical modeling studies of biogas production in a region need to be done carefully. The formulation waste power plant models with engine HCCI, is based on the reference model and reference experimental results of each part in the power plant waste that includes, production of biogas from landfill, biogas filter, generator power conversion HCCI. The production of biogas from landfills using multicomponent models, biogas filter using a filter system with a suspension of dolomite, and for the conversion of electricity using a generator HCCI referring to the results of experiments that has been conducted by Bedoya,2012. Waste power plant modeling result shows, if power output 3.725 .10^{-3} of capacity HCCI engine fuel consumption.

Index Terms-HCCI Generator Engine, modeling, waste power plant.

INTRODUCTION

Waste management is cruisal problem for major cities in all countries. The problem increases significantly every year related to solid waste in urban areas called Municipal Solid Waste (MSW). MSW uncontrolled, would affect human life through contamination of ground water as a source of drinking water and air. Besides disturbing human respiratory, air pollution also has the potential to add to the content of greenhouse gases causing global warming and climate change.

Technically, MSW biological processes can be converted into LFG (landfill Gas), which can then be used as an energy source for electricity generation. VOC (Volatile organic compounds) content in LFG or biogas only halogen-containing compounds, chlorine and other compounds and tracked (trace elements) in a very low number. It is an indication that the biogas fits for use as fuel for the power plant (Naros, 2009). LFG utilization as fuel for power generation is also supported by the presence of motor fuel engines based HCCI (Homogeneous Charge Compression Ignition) (Bedoya 2012). The utilization of biogas in HCCI engines can reduce the content of hydrocarbons in emissions. Besides the presence of CO2 in the biogas,it is beneficial to absorb the gas combustion heat release. Thus, the exhaust gas temperature is not too high, as is usually the case in HCCI diesel engine (Nathan, 2010).

Mathematical models are needed to provide a detail description about the potential electrical energy, biogas consumption per hour, generating operating time, full-time landfill. Furthermore the results of this modeling can be used as a reference in the feasibility test waste power plant development in a region. Therefore, the purpose of this study is to obtain a model of this mathematical equation.

RESEARCH METHODOLOGY

Waste power plant models with HCCI engine formulation is based on the reference model and reference experimental results of each part in the waste power plant, including the production of biogas from landfill, biogas filter and HCCI generator power conversion. Waste power generation systems to be modeled as in the following scheme,

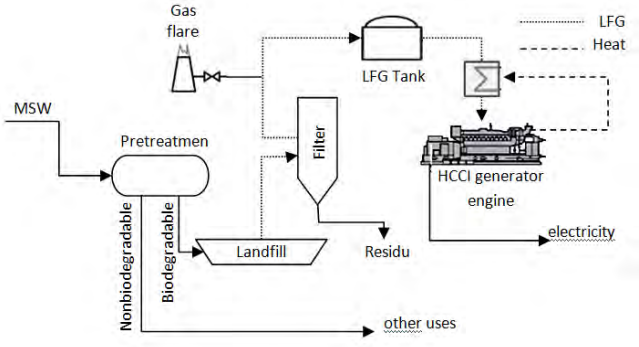

Figure 1. Waste Power Plant scheme

The production of biogas from landfills uses multicomponent models (Mahar, 2014). This model the closest estimation of LFG production with the landfill

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pretreatment system controlled. For biogas filter use a filter system with a suspension of dolomite (Makarevicience, 2015). This filter system reduces the content of CO2, H2S and H2O in the biogas. The conversion of electricity uses a HCCI generator referring to the results of experiments that have been conducted Bedoya (2012). Modeling is prepared by combining the model and the value of each piece. Modeling is generated in the form of mathematical equations.

RESULTS AND DISCUSSION

Biogas production using multikompone models. This model shows, one ton of garbage to produce about 235 m^3 LFG. The anaerob process lasts about 400 days.

Filter systems using dolomite suspension. the amount of flow needed dolomite suspension, which amounted to 39.6 m^3/h with a temperature of 20-30 °C. Concentration of dolomite in suspension is 2%, this system will generate LFG that has been purified with the speed of 280 m^3/h. Concentration of CH4 has increased, from 58% to 83%.

The power generated waste power plant is affected by the capacity of the machine. The more increase the amount of fuel consumsion. Stoichiometric combustion ratio is set at 0.4, with a mixture pressure of 2.2bar. In this condition, combustion efficiency will be obtained more than 80%, and the efficiency of the system is 40%. The amount of LFG that can be generated by the landfill will affect how long PLTSa can operate. For one ton of MSW can generate 235.31 m^3 LFG. While the number of LFG is influenced by how much MSW in landfills. The amount of waste that can be accommodated by the landfill and landfill capacity is affected by the density of MSW. Waste power plant modeling results using HCCI engine can be written as follows,

$$P_{out} = 3{,}725\,.\,10^{-3}.K_{bm}$$

With,
P_{out} is HCCI generator output power (MW)
K_{bm} is capacity HCCI engine fuel consumption (m^3 / hour)

As for the plant operating time can be written as follows,

$$t_{op} = 0{,}019.(1 - g_{los}).m_b.t_l/K_{bm}$$

With,
t_{op} is operational time of plant (Year)
$g_{los}$is loses of LFG (%)
m_b is Mass of biodegradable waste (Ton/day)
t_l is full time landfill (day)
$K_{bm}$is capacity HCCI engine fuel consumption (m3/hour)

For full-time landfill can be written,

$$t_l = \frac{L.D}{m_b/\rho_s}$$

With,
L is landfill area (m^2)
D is depth of Landfill (m)
m_b is mass of biodegradable waste (Ton/day)
ρ_s is density of biodegradable waste (Ton/m^3)

CONCLUSION

Conclusions of this study is,

1. The power generated by the plant affected by the capacity of the machine.
2. The amount of LFG produced determine how long the plant can operate
3. Waste power plant modeling result shows, if power output 3.725 $.10^{-3}$ of capacity HCCI engine fuel consumption.

BIBLIOGRAPHY

[1] Narros A, Del Peso MI, Mele G, Vinot M, Fernández E, Rodríguez ME. 2009. Determination of siloxanes in landfill gas by adsorption on Tenax tubes and TD-GC-MS, *In: Proceedings of the twelfth international waste management and landfill symposium*. Italy: CISA Publisher.

[2] Bedoya, Ivan D. 2012. Experimental study of biogas combustion in an HCCI engine for power generation with high indicated efficiency and ultra-low NOx emissions, *Energy Conversion and Management* 53 (2012) 154–162.

[3] Nathan S S. 2010. An experimental study of the biogas–diesel HCCI mode of engine operation, *Energy Conversion and Management* 51 (2010) 1347–1353.

[4] Mahar R B, Sahito A R, Yue D. 2014. Modeling and simulation of landfill gas production from pretreated MSW landfill simulator, *Front. Environ. Sci. Eng*. DOI 10.1007/s11783-014-0685-6.

[5] Makarevicience V and Sendzikiene E. 2015. Technological assumptions for biogas purification, *Environmental Technology,* 10.1080/09593330.2015.1008585.

Model Based Controller With Internal Model Control (IMC) Which Tunning By Set Point and Disturbance on Power Plant Based HYSYS

Hendrik Elvian Gayuh Prasetya[1] and Totok R. Biyanto[1]

Abstract – Waste heat recovery generation (WHRG) is a power plant systems which utilize waste gas in process of industrie. To design plant of WHRG need right control parameters for maintain heat and mass balance. The control technique of PID is the methode usually used in all industrie by doing tunning based of changes set point changes. In fact, not only based on the change of set point tunning can generate proper response, but the value based on disturbance change of tunning is also appropriate for used. This is due to value based on tunning disturbance can reduce the nuisance value of direct entry at the output of the process. The tunning of the set point value is given i.e. ± 5%, ± 10% and ± 15% of the design data are used, whereas for tunning of disturbance value that is used i.e., ± 5% of the value of the input parameter used as a disturbance. Based on the resulting control response indicates that the method for use to control the tunning disturbance in this research, it is not appropriate to be applied using methods of IMC-PID. This is due to the characteristics of the resulting response indicates a value that is less good.

Keyword : Waste Heat Stem Generator (WHRG), Tunning, Set Point, Disturbance, IMC-PID.

INTRODUCTION

At this point, the electrical energy consumption in Indonesian increased every years. Not only in Indonesia, the level of electricity consumption across the world were increased too. Based on studies conducted in Badan Koordinasi Energi Nasional (Bakoren), which estimates that demand for electricity in Indonesia increased by 3.4% per year and totaled approximately 8146 petajoules (PJ) in 2025 (Bakoren, 2010). This is because as many sources of electricity which comes renewable energy, such as solar power, wind power, water-flow biological processes, and geothermal untapped optimally (US National Energy Laboratory Revnewable, 2012). Because the needed of electrical energy is on the rise in every year, it can cause a power outage cycle through which many complain about by the publics (Kompas, 21 July 2012).

One of the step to reduce these problems is by creating electrical energy sources independently. The independently of electric energy sources can obtained from the using exhaust gas that is present on a wide range of industries, and the exhaust gas still have a high thermal value for use as a steam power plant system (Umamaheswari, 2013). Utilization of exhaust gas as an energy source steam power was called WHRG (Waste heat recovery generation). The WHRG is an electricity generation system utilizing exhaust gas from a chemical process, so this much of power system used in the chemical industry.

IMC-PID control techniques are applied to power plant with tunning the changes of set point. In fact, not only based on tunning set point changes can generate the proper response, but the value based on disturbance tunning is also appropriate for use. On the disturbance tunning can reduce the nuisance value of direct to entry at the output of a process (Biyanto, 2013). There are two kinds of provisions in order to make a precise tunning, i.e. the first such control systems including servo into the problem or regulatory problems, and the second is using control algorithms or tunning usually use internal control. On the last research previously done by Asana Kusnadi with the subject design of controller and response analysis using Internal Model Control (IMC) has carried out the controls on power plant aims to produce a response in accordance with the set point and reduce the level of disruption that go directly at the output of the process. However, this only applied to the unit operation Heat Exchanger only. Therefore, in this research will be designed a model based analysis of controller by using internal model control (IMC) which tunning based on set point change and disturbance change on the power plant based HYSYS software.

RESEARCH METHODOLOGY

To achieve the objectives that have been set, the required methodology as stages that must be done in completing this final task. As for the methodology:

A. Modeling and validation of data

To design a model waste heat recovery generation system with using HYSYS software, then the necessary datas that will used, i.e. the form of the composition, temperature, pressure, and the mass flow rate in each stream will be used. On the design of WHRGS there are

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two kinds of input values, i.e. the flue gas to be used as heating and feed water in which will be turned into steam.

B. Test of design power plant

After the necessary data is obtained, then the first step is to do design of WHRGS with HYSYS software. Design systems used i.e. There are two kinds, the first is the design of steady state and the second is a dynamic design. Design of steady state function to simulate the processes that exist in design, but this does not change the design to changes in time. While the dynamic design is a design depicting a real model, this is because the design is constantly changing – change of function of time. In this dynamic design that serves as a controlller required guards to defend the value of the calculation of the heat and mass balance. The operation of unit will be used i.e. There are 4 kinds, namely heat exchanger, steam drum, pumps, and turbine. The four operating units will be simulated in software HYSYS 7.3 obtained in the file HYSYS (*. hsc).

C. Tunning set point and disturbance

The design of waste heat recovery generation system control parameters to note that on the unit operation vessel. This is because the value of inputs and outputs on this unit operation is always changing change of time function. On this vessel operating unit there are three kinds of control parameters are used, i.e. FIC-100,P-100, and LIC-100. The third type of mounting the control parameter because the value of inputs and outputs on the unit operation vessel is always changing – change of time function. The procedure is done to make changes based on the current set point of tunning on the design WHRGS is the following:

a. Open loop data retrieval
b. Define controll parameter
c. Determine kC, Ti, and Td based on IMC-PID table.

D. Perform test based on set point and disturbance tunning

A test based on value set point and disturbance tunning are important to do, this is due to both the tunning with testing we can know that based on the value of Kc, Ti, and Td has been granted can change the response of the process variable (PV) that have been produced. A good-value can be said to tunning in the tunning given can produce a response process variables follow value has been set. But instead, a value can be said to tunning is no good if the value of tunning that was given was unable to produce a response process variables.

RESULTS AND DISCUSSION

In this chapter will be done testing and data analysis modeling system on waste heat recovery generation system. The first test will be carried out, namely the determination type of mounting the controller which will be used for the model plant. In addition, there are two kinds of model plant trials using HYSYS software, which changes the set point and the disturbance.

A. Determine controller type that used in design of waste heat recovery generator system.

The need for this controller can be seen from the response of each stream is provided.If the value of the response stream that is generated is always changing – the change of time function to the given design data, then in the stream must be paired with a controller that serves to maintain the value of heat and mass balance. Figure 1 show controller on steam drum.

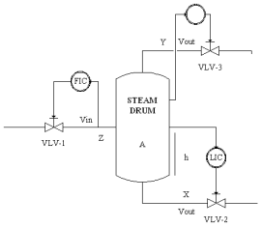

Figure 1. Control structure on steam drum.

B. Test open loop based on set point and disturbance

The third type of controller in HYSYS software demonstrated by FIC -100, PIC-100, and LIC-100. For know the stability controller is required tunning to accelerate the desired steady response, as well as reduce the incidence of error. Therefore, the required value of tunning Kp, Ti, Td and the right to achieve both these things.

C. Test close loop WHRG plant based on set point and disturbance.

The close loop testing is the method tested of the value of the parameter being performed upon installation of the value given in the kontroller WHRG plant. The usefulness of this close loop test is to know the resulting system response based on the parameters of the given control. On the simulation of the plant there are two kinds of WHRG values test close the loop, the first is a test based on the value of the change set point and the second is the value to test against changes to disturbance.

REFERENCES

[1] Garcia, Vera., Cascales, Garcia. 2010. A Simplified Model For Shell and Tube Heat Exchanger : Practical Application. Spain : Universidad Politecnica de Cartagena.
[2] Smedsrud, Helge. 2007. Dynamic Model and Control of Heat Exchanger Networks. Norwegian :Norwegian University.
[3] Wahid, Abdul., Gunawan, Rudy. 2010. Metode Korelasi Baru Pada Penyetelan Pengendali PID Dengan Pendekatan Model Empirik FOPDT. Jakarta : Norwegian University.
[4] Ogata, Katsuhito. 1997. Teknik Kontrol Automatik. Jakarta: Erlangga.
[5] Luybean , William L. 1989. Process Modeling, Simulation and Control for Chemical Engineers. McGraw-Hill Companies; 2 Sub edition

Evaluation of The Suitability of Urban Parks Based on The Characteristic of The Elderly's Needs in Surabaya

Anindita Ramadhani[1], Endang Titi Sunarti Darjosanjoto[1], and Murni Rachmawati[1]

Abstract – The number of elderly people in Surabaya City is growing fast, with the largest population in Development Unit (UP) Tunjungan. It resulted to the needs of elderly facilities, such as parks. The elderly have certain characteristics, so the designing of elderly park need a specific approach. Therefore, the research's objective is to evaluate urban parks in UP Tunjungan that suitable for characteristic of the elderly's need. The research's methods is qualitative descriptive. The evaluation of eight parks in UP Tunjungan based on general criteria of elderly park through character appraisal analysis. The result is to find out the most suitable park to be designed as Elderly Park that meets 7 out of 10 sub criteria of an elderly park.

Index Terms - elderly park, characteristic of elderly people, the suitable park, character appraisal.

INTRODUCTION

Surabaya City has a rapid growing of elderly people. In 2010, the percentage of elderly people in Surabaya is 10% of total people in Surabaya. It is far bigger than the percentage of elderly people in Indonesia, that is 7,5 % of total people. In 2013, the percentage of elderly people in Surabaya had reach 16,74% of total people[1]. Demographic data of Surabaya in 2013 stated that the largest population of elderly people is in Development Unit (UP) Tunjungan. Therefore, this Development Unit is more likely to need adequate facilities for the elderly.

The aging process brings many changes to a man, physically and psychologically. Most of them are lonely retired, so they need a facility for them to interact with others, such as parks. The physical limitation of elderly people lead to their limited access to the world outside their house[2], so the park need to be accessible for the elderly. There are eight urban parks in UP Tunjungan, but none of them is addressed for the elderly. Each urban park in UP Tunjungan has a potential to be designed as an elderly park. The elderly people have different characteristic from the other age group, so the designing of Elderly Park need a specific approach. In order to find out the best location for designing elderly park in UP Tunjungan, the parks need to be evaluated based on characteristic of the elderly's needs; accordingly, the research question is: "Which park in UP Tunjungan that is potential to be an elderly park?".

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METHODS

The methods of this research was qualitative descriptive. The evaluation of eight parks in UP Tunjungan based on general criteria of elderly park through character appraisal analysis[3]. The data was presented by data display formation contained information of the evaluated parks and analyzed by character appraisal techniques to determine one most suitable park.

FINDING AND ARGUMENTS

According to Carstens (1993) [4], Mollenkopf, dkk (1997) [5], and Joseph J. Gallo (1998) [6], the distinct characteristics of elderly could be divided into two, namely physical characteristic, and psychological characteristic. Physical characteristic of elderly consisted of the decreasing in sensory ability, physical strength, and adaptability towards the surrounding. Psychological characteristic of elderly consisted of the decreasing of social interaction and shock from status change. These characteristics lead to some special needs, such as physical needs, safety needs, and social needs (Henniwati 2008[7], Maslow in Koswara 1991[8]). The needs characteristic of elderly must be fullfiled in determining the suitable park for the elderly. The elements and location of elderly park will be assessed due to the elderly needs. Safety needs mostly affect the choice of suitable location for elderly park. Physical needs affect the choice of hardscape and softscape elements in the park. And, social needs affecting the development of interaction spaces in park for senior communities.

Eight urban parks in UP Tunjungan to begin with are Prestasi Park, Korea Park, Apsari Park, Undaan Fruit Park, Surya Park (town hall's courtyard), Alon-Alon Contong, Skate and BMX Park, and Ekspresi Park[9]. The eight parks to be reduced as five parks due to incompatibility of three parks, Apsari Park, Surya Park, and Skate and BMX Park, to make out of basic elements of elderly park.

The remaining five parks were presented as "data display" that contained all basic information of the parks. The data became input to be assessed based on 6 criteria and 10 sub criteria of elements and location of elderly park, i.e. accessibility (street, distance from the settlement, and public transportation), safety, comfort (appropriate space for the park), community and social relation (elderly population around the park, facility for the elderly near the park), physical elements (hardscape and softscape), and space for interaction. The park that met most of the criteria and sub criteria was assigned to be most suitable park as elderly park.

Ekspresi Park met 7 out of 10 sub criteria, which was the highest points among the other. Ekspresi Park as the most suitable park was accessible by public transportation, there is a settlement close by, and got adequate space, dense vegetation, also the only park out of the five that has an elderly facility at the park that is foot reflexology path.

CONCLUSION

The result of this research submits that the most suitable park to be designed as elderly park in UP Tunjungan was Ekspresi Park. The park met 7 out of 10 sub criteria of elderly park.

REFERENCES

[1] Surabaya in Figures 2014.

[2] Francis, Carolyn dan Clare Cooper Marcus. 1998. People Places: Design Guideliness for Urban Open Space Second Edition.Canada.:John Wiley & Sons, Inc.

[3] Ministry for the Environment. Urban Design Toolkit Third Edition. 2006. New Zealand : MFE.

[4] Carstens, Diane Y. 1993. Site Planning and Design for The Elderly: Issues, Guideliness and Alternatives. Canada: John Wiley & Sons.

[5] Mollenkopf, Heidrun, dkk. 1997. Outdoor Mobility and Social Relationship of Elderly People. Archive of gerontology and geriatrics.

[6] Gallo, Joseph .J. 2006. Handbook of Geriatric Assesment. Massachusetts: Jones and Bartlett Publishers.

[7] Henniwati. 2008. Faktor-Faktor yang Mempengaruhi Pemanfaatan Posyandu Lanjut Usia di Wilayah Kerja Puskesmas Kabupaten Aceh Timur. Medan: USU.

[8] Koswara. 1991. Teori-teori Kepribadian. Bandung : Eresco.

[9] -. 2012. Kajian Optimalisasi Pemanfaatan Ruang Terbuka Hijau Publik di Kota Surabaya. Surabaya: Badan Pembangunan Kota Surabaya.

Waste Transportation System Optimization on Azzahara Material Recovery Facility (MRF) Bengkulu City

Rendra Satria[1], Putu Artama[1], and Joni Hermana[2]

Abstract - Bengkulu city as the capital city of Bengkulu province, in 2013 had a population of 334.529 inhabitants, with waste generated at 10,003.59 m3 / day. Coverage of waste management services in the city of Bengkulu has recently reached 33.01% or 331.29 m3 / day of the total waste. The effectiveness and efficiency waste transport system will increase the amount of waste transported and more communities are underserved. This research aims to improve the coverage of waste service by waste transportation system optimization. Analysis of optimization solid waste transportation system implemented by creating a network problem model and linear programming problem, generate the decision of how many trip of each conveyance and obtain maximum volume of waste transported.

Index Terms - linier programming problem, network problem, waste processing, waste transportation system.

INTRODUCTION

Bengkulu city located on the west coast of Sumatra island that is connected directly to the Indonesian Ocean and geographically located between 3°45' – 3°59' South Latitude, 102°14' - 102°22' East Longitude. Bengkulu city has a total area 539,3 square kilometer consisted of 151.7 square kilometer land area and 387.6 square kilometer sea area.

Population density of Bengkulu city was about 21 inhabitants/hectare with population growth rate of 2.54% (BPS Bengkulu Province, 2014), which it cause an increase in the rate of waste generation. An increase in the rate of waste generation can not be offset by an increase in facilities and infrastructure waste services. This waste generation needs to be managed properly in order to give no negative impact on the environment.

To increase coverage of waste service can be performed with the addition of a new conveyance vehicles to replace old vehicles transport equipment and supporting facilities. But, it would be ineffective for the long term because it will increase the burden of government in waste management costs. Another way to improve solid waste service coverage is to perform waste transport system optimization.

Financial aspects is an important component in the waste services. Transport phase is a very important phase because it consume the financing of 40-60% of the total waste management cost. By implementing an effective and efficient system of waste transportation, could increase the coverage waste services in Bengkulu city.

METHODS

Research methods used data collection and field observations. Data collection through literature studies conducted to get the theoretical basis supporting research creating the data analysis. Literature study are includes technical aspects, institutional aspects, and financing aspects. Field observations conducted to obtain the data of conveyance's capacity, travel route, long transport time.

Field observation was conducted to all waste conveyance's vehicle that operated in service area of Azzahara Material Recovery Facility. There were 12 waste conveyance's vehicle consisting of 6 Dumptruck and 6 Armroll truck. The service area covers four districts, there are Muara Bangka Hulu, Teluk Segara, Sungai Serut, and Ratu Samban. Observation and Measurement of each set waste conveyances vehicle done 3 times in different time. It is intended to obtain objective data, representative, relevant and small variations.

Travel route of waste conveyance's vehicle is effecting to mileage, cost and time of waste transport. Evaluation of travel route carried by comparing between existing route and optimum route. The optimum route could be obtained by creating a transportation model. Using minimum cost method, obtained minimum travel time route of waste conveyance's vehicle.

I. Transportation Model

The problem is that there are sources of waste generation that need to be transport to landfills using waste conveyance's vehicle. Each vehicle had different garage site. The constrains are can not transport more than waste generation and can not transport more than conveyance's capacity. The purpose is to minimize travel time route of waste conveyance's vehicle.

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II. Linier Programming Model

To increase coverage of waste management services, should be increased amount of waste volume transported. The volume of waste transported is the total volume of waste that can be transported from each vehicle conveyance in a day. The volume of waste transported calculated by multiply between conveyance's capacity and amount of trip.

RESULTS AND DISCUSSION

To create a transportation model, travel time from each garage site to every waste source need to calculated. Using equation :

$$travel\ time = \frac{Lenght\ route}{avarage\ speed}$$

Average speed of each waste conveyance's vehicle and Lenght route are obtained from field observations. The transportation model shown as following tabel.

TABLE 1. TRANSPORTATION MODEL.

	AR.1	AR.2	AR.3	AR.4	AR.5	AR.6	AR.7	S
K.1	80,78	134,09	92,39	99,75	137,94	90,21	92,11	
	1			1				2
K.2	117,63	154,82	129,65	151,13	183,66	95,09	144,55	
						1		1
K.3	80,78	147,26	97,52	116,30	152,60	91,21	109,22	
	2							2
K.4	96,97	158,88	113,53	133,60	174,53	97,93	128,02	
						1		1
K.5	88,01	168,75	89,36	105,55	136,89	96,36	90,71	
							2	2
K.6	143,20	252,81	160,61	142,63	201,81	149,32	165,78	
				1				1
K.7	96,05	157,68	89,12	126,94	157,54	103,13	109,36	
			2					2
K.8	91,49	152,23	85,89	121,55	151,71	98,19	106,22	
			1			1		2
K.9	102,02	166,12	94,99	119,54	155,50	109,12	103,92	
			1				1	2
K.10	82,41	133,26	90,42	105,05	137,08	91,16	92,79	
		1						1
K.11	81,73	132,78	89,15	103,25	135,47	90,63	92,29	
		2						2
K.12	96,86	154,07	99,42	94,86	123,71	105,36	84,03	
					1			1
K.13	82,73	128,66	95,16	66,63	91,76	92,22	72,88	
					1			1
K.14	82,06	140,72	94,28	116,09	150,36	88,65	111,47	
						1		1
K.15	92,26	146,74	88,14	117,78	147,74	98,99	99,34	
							1	1
K.16	86,94	139,86	93,36	111,05	144,19	97,16	96,76	
	1	1						2
K.17	87,91	141,78	93,27	90,89	127,93	95,71	78,30	
				1				1
K.18	81,65	132,87	88,55	83,10	115,69	90,11	76,35	
				1	2			3
D	4	4	4	4	4	4	4	

Using northwest corner method, transportation model had solved. Compiled linear equation to obtain optimum volume of each vehicle conveyances. Operational cost and operational time are determined as constrain variable to perform linier programming model. The objective function to be maximized of the following form :

$$Z = C_1.X_1 + C_2.X_2 + C_3.X_3 + C_4.X_4$$

Problem constraints of the following form:

- Operational cost constraint

$$A_{11}.X_1 + A_{12}.X_2 + A_{13}.X_3 + A_{14}.X_4 \leq B_1$$

- Operational time constraint

$$A_{21}.X_1 + A_{22}.X_2 + A_{23}.X_3 + A_{24}.X_4 \leq B_2$$

- Positive and integer variable constraint

$$X_n \leq 1\ and\ Integer$$

Applying optimum route, all conveyance's vehicle could deliver 28 trip of container per day. The total volume of waste that could transport to landfill amount 216,535 m^3 per day. Comparing with eksisting route, all conveyance's vehicle could deliver 20 trip of container per day. Total volume of waste that transported to Landfill amount 154,668 m^3 per day.

CONCLUSION

Optimum route calculated with transportation model using northwest corner method, amount of total volume of waste that could transported to landfill increase 40 % from 154,668 m^3 per day become 216,535 m^3 per day. Increasing the amount of waste transported could improve the coverage of waste service.

REFERENCES

[1] Leong, K.C, *The Essence of Asset Management*, Published by UNDP-TUGI Kuala Lumpur, Malaysia, 2004.

[2] Siregar, D.D*, Manajemen Aset*. PT. Gramedia Pustaka Utama, Jakarta, 2004.

[3] Olis Bakari, *Optimasi Sistem Pengangkutan Sampah Di Kota Gorontalo.* Tesis Magister, Institute Of Technology Sepuluh Nopember, Surabaya, 2013.

[4] Kurniawan, *Kajian Kelayakan Tempat Pengelolahan Sampah Terpadu (TPST) Dalam Meningkatkan Cakupan Pelayanan Sampah Di Kota Bengkulu*, Tesis Magister, Institute Of Technology Sepuluh Nopember, Surabaya, 2013.

[5] Departemen Pekerjaan Umum, *Pedoman Operasional dan Pemeliharaan Prasarana dan Sarana Persampahan*, Ditjen Cipta Karya, Jakarta, 2009.

[6] BPS Kota Bengkulu, *Kota Bengkulu Dalam Angka 2011* Bengkulu, 2011.

[7] Badan Standardisasi Nasional. " SNI 3242-2008." in *Tata Cara Pengelolaan Sampah di Permukiman*. Jakarta, 2008.

The Arrangement of Downtown Area as Effort to Represent Identity of Ambon [Case Study: A. Y. Patty Street Area]

Kreisson Pisty Larwuy[1], Endang Titi Sunarti Darjosanjoto[1], and Murni Rachmawati[1]

Abstract – City is basically an expression of human life which is manefestation in the form of mass and space. This demonstrates the need for the city in terms of the functional aspects. The Downtown area of the city of Ambon is one strategic area, multi-functional and loaded with historical value, which has been badly damaged by the riots. For the study of the arrangement of the this, needs to developed in order to create environment moreover to bring the city 's identity as a whole. This research uses historical approach and qualitative descriptive approach. Data was collected and will be analyzed, by using synchronic reading and diachronic reading. The results of this study is to bring back the unique identity of Ambon city, the culture Pela Gandong- Baku Dapa urban communities that have been lost due to social conflict.

Index Terms – urban identity, pela gandong -baku dapa, the arragement social conflict.

INTRODUCTION

Ambon is a city with a unique identity. Ambon city identity shaped by cultural and community characteristics . In social terms, Ambon city was influenced by the culture of the people who are well known in Ambon known as "Pela Gandong", which is the bond of brotherhood between the two villages/villages are usually different ethnicities and religions, either adjacent or even distant geographically.

Sociology bond that forms the character of Ambon into a city with unique character that has a heterogeneous society - made up by various races and religions. In terms of the demographic and ethnicity, Ambon is a portrait of a pluralistic city. In this town dwelling so many ethnic. Ethnic Alifuru (original Moluccas), Java, Bali, Buton, Bugis, Makassar , Papua, Indonesia , Minahasa, Minang, Flobamora (the tribe of Flores, Sumba, Alor and Timor, and of course those descendants foreign (Chinese community, the Arab community-Ambon, Spanish community-Ambon, the Portuguese community-a community of Ambon and the Netherlands - Ambon). Growing religion in the city of Ambon is Islam, Christian, Hinduism and Buddhism. Community groups with differences like these that form the character of the Ambon city.

In the years 1999 - 2003 social conflicts that resulted in deterioration in various aspects of community life in the city of Ambon. The Characteristic of the city of Ambon is famous for its "Pela Gandong " was destroyed . Ambon city communities that previously lived side by side in peace and security, of various races and religions, in the end live separately. There is a suspicious, hatred and even vengeance prolonged. At the end of the post-impairment urban communities demographically live separately . Muslim community prefers to live and settled on the north side , while the Christian community prefer to live in an area south of the region 's AY Patty .

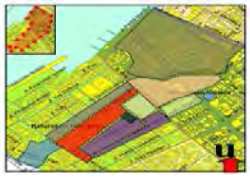

Figure 1. The Existing Of A.Y. Patty Street Area.

Problems were found in the area AY Patty is the concept of regional arrangement that has not been good, the structure of the city that are not clear, the placement of land use does not function properly, resulting inconvenience for people in the A.Y. Patty street area. This issue increasingly evident with the separation of the demography by both ethnic and religions in the AY Patty street area as resident. Due to this phenomena that occur in the area, it needs a conservation activity by government and civil society to fix this issue.

METHODS

The research method applied to the study was descriptive qualitative. It discussed existing data of A. Y Patty street area. The data will be collected and analyzed by using synchronic reading techniques.

FINDING AND ARGUMENTS

Ambon city identity, can be achieved by using diachonic reading analyis. This analysis is to tracking the origin of the history associated with the object under study[1]. This search form of the data of the respondents,

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informants who know the history of regional development, regional development map, photo mapping,

After that, using a character apprasial analysis, to find characteristic of A.Y Patty street. Character Appraisal analysis is an analysis tool to identify patterns of development and characteristics of a part of the city area. Analyzer This is useful for assessing and understanding the characteristics of the environment and building in this area[2]. This method apllied to each areas in the city : Economic-services, Settlement, Military, Government, Religius, Open Space, Education.

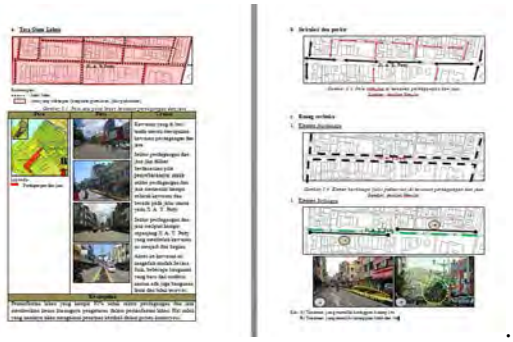

Figure 2. SAMPLE of Character Appraisal Analysis.

After doing the following analysis, the result will be synchronized with theory and city history-the present of city condition which is achieved by using diachonic analysis. Finally, the criteria can be achieved to develop a concept of an arrangement the city.

TABLE 1. THE CONCEPT DESIGN SUMMARY.

Subject	Criteria	Concept Design
History	All historical building must be maintained and preserved.	Raising a strong sense of place to buildings that have high historical elements in the region AY Patty
Culture	Restore the culture and characteristics that have faded	Create a special area as an area of "Baku Dapa" which appeals to the public, such as a cafe, a place to dance.
Land Use	provide a relaxing area for people	• Creating a Special Parking Area. • Creating a Special Area PKL. • Creating a Relaxed place on Main Street. • Eliminate slums.
Circulation	Need to regulate the circulation of entry / exit road users to and from the region AY Patty very well.	Setting the circulation path and better parking
Open Space	All statue,sculpture must be laid out better in order to become an icon in the AY Patty.	Creating a strong impression for this area to make it look more beautiful, attractive for visitors and residents of the city.

CONCLUSION

The result of this research submits that A.Y Patty street area need to be conservation by using Revitalization method. Revitalization can be applied in residential areas, religon areas, administration areas , open space area . The goal is to foster a sense of trust, security and comfort for the people of the area. So as to turn the AY Patty culture that used to back so that togetherness it can be reformed.

REFERENCES

[1] Darjsanjoto, Endang T. S, 2006. Penelitian Arsitektur di Bidang Perumahan dan Pemukiman, ITS. Press, Surabaya.

[2] http://www.mfe.govt.nz.tribunnews.com, accessed at 10/9/2014).

The Partnership Benefits in Low-cost Apartment Implementation Program in Surabaya Metropolitan Area

M. Muntoha[1], Ria A.A. Soemitro[1], and Farida Rachmawati[1]

Abstract-The low-cost apartment implementation program is one of the reliable solutions to reduce housing needs in East Java Province. Eventhough there were many problems facing the low cost apartmen program implementation, private sector is still highly expected to contribute in this program.
The objective of this research is to identify public private partnership benefits from stakeholder perception. The benefit variables to better understand the low-cost apartment implementation which obtained from literature review studies were then validated by 32 purposive sampling respondents from both government and private sectors. These variables were then identified and analyzed using statistical analysis.
The results show that the benefit factors from both government and private sector perception are better risk allocation and accelarate infrastructure development.

Index Terms-Benefit, Low-cost apartment, Public Private Partnership Surabaya Metropolitan Area.

INTRODUCTION

One of procurement and partnership method is Public Private Partnership which has been applied in a lot of infrastructure projects. PPP plays an important role in bringing private sector competition to public monopolies in infrastructure development and service provision, and in merging the resources of both public and private sectors to better serve the public needs that otherwise would not be met [1]. In Indonesia, PPP has been implemented in some infrastructure projects such as toll road, power plant, railway, water supply and sanitation [2]. Unfortunately, only a few private sector who are interested to participate by building partnership in housing project, especially in low-cost apartement development.

However, due to its advantages, PPP is still considered to be applied in infrastructure development. This partnership has benefits: PPP have developed in part due to financial shortages in the public sector and PPPs have demonstrated the ability to harness additional financial resources and operating efficiencies inherent to the private sector [3]. Eventhough there are some risks concerning PPP implementation in housing projects, the partnership in this fields is still possible to be adopted more extensively. Certain critical conditions must be satisfied for the PPP model to succeed [4].

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Some researches have studied about partnership benefits in some countries in infrastructure project for general. [5], who carried out a survey to investigate the attractive factors for adopting PPP in the UK, revealed that the top three attractive factors include "transfer of risk to private sector", "solving the problem of public sector budget constraints" and "non-recourse or limited recourse public funding". While [6] has identified the top three partnership benefits in Malaysia such as solve the problem of public sector budget restraint, provide an integrated solution and facilitate creative and innovative approaches.

Moreover, this paper is aimed to examine the partnership benefits in low-cost apartment implementation program in Surabaya Metropolitan Area, so that the factors are considered as factor attracting the use of PPP in low-cost apartment implementation program in Surabaya Metropolitan Area. The PPP implementation include three stages: land providing, construction and operational maintenance. In particular, there are two objectives of this present study. First, it aims to examine the importance of partnership benefits as perceived by the overall respondents. Second, the study intends to identify the differences in perception concerning the importance of the success factors between the public and private sectors.

METHOD

The study adopted variables from the previous research concerning Public-Private Partnership (PPP) benefits with some reductions and adjustment to make it more realistic. The rationale for adopting similar benefit factors to those used in prior studies, particularly by [3], [5], [6], [7] and [8].

The survey was conducted to low-cost apartment manager (public and private sector) in Surabaya Metropolitan Area under the partnership agreement. There are 3 low-cost apartments with different scheme, namely Graha Asri (Private sector rents the land while Public sector builds and operates the building), Warugunung (Build Operate Transfer) and Siwalan Kerto (private sector operates the building) . In all, 32 completed questionnaires were returned out of the 32 distributed. Of these, 17 respondents came from public sector (Surabaya Municipality Government, East Java Province Government) and 15 from the private sector (investor, potential investor and management team).

The relative importance of the partnership benefit factors was analysed by means of Likert rating scale

questions in the survey instrument. The scale were very important (5), important (4), moderate (3), unimportant (2) and very unimportant (1). Statistical analysis undertaken include reliability test and importance analysis. The cronbach alpha reliability for the factors is 0.773, which means the data collected for the partnership benefits are reliable.

RESULT

The findings are presented in the following manner: (1) the overall results on the attractive factors, (2) the differences between the public and private sectors on the attractive factors. The rank is comprised and presented in the table 1 below.

TABLE 1. RANK OF VARIABLES

No	Benefit	Overall	Public sector	Private sector
1	The ability to harness additional financial resources and operating efficiencies inherent to the private sector	10	15	6
2	Better access to capital and reduced whole life costs	3	4	3
3	Generation of additional revenues	7	6	10
4	Benefit local economic development	4	5	4
5	Improved quality service	5	7	5
6	Acceleration of infrastructure provision	2	2	2
7	Faster implementation	11	12	7
8	Better risk allocation	1	1	1
9	Better incentives to perform	13	14	11
10	Enhanced public management	12	9	15
11	Increased understanding of parties	15	13	13
12	Improved design	8	8	9
13	Increased market share	14	11	14
14	Improved maintanability	6	3	12
15	Improved buildability	9	10	8

Better risk allocation is the first and important benefit based on overall, public and private perceptions. [5] and [6] mentioned that transfer of risk to private sector variable is the most attractive factor for PPP implementation. That is why, using proper risk sharing mechanism, both public and private sector might be able to manage some types of risk more effective which ultimately lead to a better quality of services provided, cost savings and the reduction of risks taken on by the government. While accelaration of infrastructure provision is the second benefit according to overall, public and private perceptions**.** The result is in line with [6] concerning PPP advantage to fasten delivery of public infrastructure, because the private sector is perceived as being more innovative and efficient due to their competitive commercial environment.

Private sector found the advantage of PPP in public sector's budget reduction. This variable is placed in the third rank by overall and private sector's perception, and in the forth rank by public sector's perception. [6] examined that PPP may solve the problem of public sector budget restraint and reduce government allocation to project development.

Based on the results shown in table 1, the findings indicate that there are significant differences in the perceptions of the public and private sectors except in the cases of two factors: (1) improved maintainability", the public sector respondents perceived it as being significantly more important than the private sector respondents. it is belief that the private sector management is more efficient and innovative than the public sector. (2) improved quality services, which private sector respondents considered to be attractive factor because PPP enables private sector to create consortium to provide high quality of service [8].

CONCLUSION

The partnership benefits from both public and private sector are better risk allocation, accelaration of infrastructure provision and reduced whole life costs. While the significant benefit from the private sector's view is improved quality service. The variable "improved maintainability" is perceived by the public sector.

REFERENCES

[1] Zhang, X., and Chen, S, 2013, *A Systematic Framework for Infrastructure Development Through Public Private Partnership,* International Association of Traffic and Safety Sciences (IATSS) Research no 36 (2013), Elsevier

[2] National Development Planning Agency, 2013, Public Private Partnerships, Infrastructure Projects Plan In Indonesia

[3] European Commission, 2003, *Guidelines for Successful Public Private Partnership*

[4] Wibowo, A and Alfen, H.W, 2014, *Identifying macro-environmental critical success factors and key areas for improvement to promote public-private partnerships in infrastructure*, Engineering, Construction and Architectural Management, Vol. 21 Iss 4 pp. 383 – 402

[5] Li, B., Akintoye, A., Edwards, P.J. and Hardcastle, C., 2005. *Perceptions of positive and negative factors influencing the attractiveness of PPP/PFI procurement for construction projects in the UK: Findings from a questionnaire survey*. Engineering, Construction and Architectural Management, 12(2): 125–148

[6] Ismail, S. 2012. *Factors Attracting the Use of Public Private Partnership in Malaysia*, Journal of Construction in Developing Countries, 18(1), 95–108

[7] Susilawati, C., Armitage, L and Skitmore, M, 2005, *Partnerships In Affordable Housing: The Impact Of Conflicting Investment Criteria.* In *Proceedings QUT Research Week*, pages pp. 966-978, Brisbane.

[8] Cheung, E., Chan, A.P.C. and Kajewski, S. 2009. *Reasons for implementing public private partnership projects: Perspective from Hong Kong, Australian and British practitioners*. Journal of Property Investment and Finance, 27(1): 81–95.

The Spatial Consequences of High-Rise Building Upon The Public Space of Basuki Rahmat Corridor, Surabaya

Annisa Budhiyani Tribhuwaneswari[1], Endang Titi Sunarti Darjosanjoto[1], and Murni Rachmawati[1]

Abstract – High-rise building functioned as a reflection of the city growth toward modernism. It indicated changes for more advanced urban development, showing the quality at various section, such as tourism, economy, and its environment. The rapid growth of vertical building creating an effect towards the surrounding environment, the public space, which need to be acknowledged and evaluated. The research method applied to the study was descriptive qualitative, mainly focused at analyzing the spatial consequences of high rise building upon the public space of Basuki Rahmat Corridor, Surabaya. The data was presented by index card and analyzed by using synchronic reading techniques. The results shows that there is relation and linkage between the public space and the high-rise building at the corridor.

Index Terms - basuki rahmat corridor, public space, high rise building.

INTRODUCTION

Basuki Rahmat Street is located at the heart of Surabaya City, the corridor connects the north and south part of the city. This strategic location creates a phenomenon in which its corridor mostly consisted of high rise building at various function. Another aspect affected by this growth is the public space. It need to be evaluated not only by its physical aesthetic but also by the needs of the social, cultural, and environmental values. Considering the needs of the users of this corridor.

From dozens of high rise building scattered accros the Basuki Rahmat street, there's only nine which sufficiently obeyed the goverment rules about building boundary. The mentioned are empire palace, dapur desa, warna office, dyandra expo, meratus hotel, ex-gelael tower, bekizaar hotel, mcdonald, and tunjungan plaza. This happened because there's new regulation that was implemented in the year of 2006, but the the building have been built long before that. One of the problem arises are traffic jam, air polution, and the poor visual quality of the corridor[1]. The negletance for obeying boundary rules also detrimental to the ease of movement for the pedestrian user, because many places are converted into parking lot and informal trading place.

Surabaya city is one of the city in Indonesia which has an international scale of its commercial and service sector[2]. The investment implemented are high rise building, which its develepmont has specific needs, caused by the users involved within it. One of the needs arises are accecibility onto public mass tranportation and informal sector which support the activity of middle to lower class people. It is also known that worker with high mobility needs space to relax and socialize preferably closer to their working place because of tight scedule[3].


Figure 1. The existing condition of public space at basuki rahmat koridor.

Despite all the fact that are pointing onto spesific needs caused by high rise building, there's still no treatment upon its public space pertaining the function itself. Improvement was made by the goverment only for its aesthetical value, such as the hardscape of the pedestrian way.This research intended to unravel the existence and relation of the public space, which supports the high rise building. Thus arises a research question, **"How is the spatial consequences of high-rise building upon the public space of Basuki Rahmat Corridor, Surabaya?"**.

METHODS

The research method applied to the study was descriptive qualitative. It discussed existing data of high-rise building at Basuki Rahmat Street and its relation to the public space affected by the needs of its building users and pedestrian. The data was presented by index card and analyzed by using synchronic reading techniques.

FINDING AND ARGUMENTS

Identifying which are the high rise building qualified to be the sample is crucial at this point to avoid unnecessary scope unrelated to the research. Thus, we

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follows the goverment regulation which mentioned that a high rise building classified into two class. Class I are high rise building with height around ≤40 m or 5-8 floors, and class II are high rise building with heigth around ≥40 m or ≥9 floors[4]. There's 19 qualified building, which are BRI Tower, Bumi Surabaya Hotel, Bumi Mandiri Office, Jatim Bank, Ibis Hotel, Dyandra Expo, Graha Pacific, Indosurya, MidTown Hotel, Meritus Hotel, Standard Chartered Bank Tower, Graha Milenium, Graha HSBC, Maspion Bank, Yamaha Plaza, ICBC, Tunjungan Plaza, Pundi Bank, and Bekizaar.

After that, the results of field observation from the building sample are to be presented into index card. The techniqued used to take the data is single directional view. The card contains information pertaining the location and numbers of buildings (keymap), summary of the characteristic, facility scattered upon its public space, and photos that shows there's relation between the building~public space.

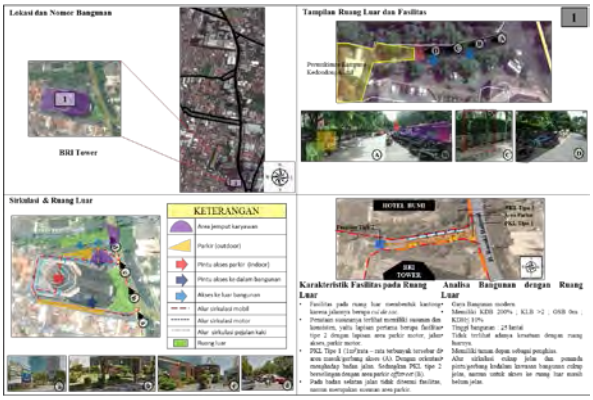
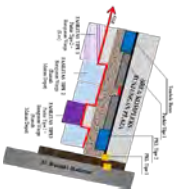


Figure 2. Sample of Index Card No.1 Pertaining The Spatial Consequences of High Rise Building upon Its public Space.

The following thus are sychronised and matched with the theory concerning public space. The indicator used to identify the relation are, the value or attachment of the street and regions to its public space. Then deciding whether it affected the vitality or imaging of its corridor, pertaining the nature of the public space mentioned is a street not a square[5].

Thus, the relation shown by the role of the public space are; It functioned as a support to the corridor vitality and the high-rise building itself. From many public space typology founded, it's concluded that there are three that are qualified (pertaining their relation to the street and region), namely :

TABLE 1.THE SPATIAL TYPOLOGY SUMMARY.

Typology	Ilustration	Information
1		Location : Kaliasin Pompa Street It is form as an open street way. It has a variety of support facility and informal sectors. More of the private house are converted as a commercial and service facility.
2		Location : Embong Belimbing Street It is form as an open street way. There are less of the private house that are converted as a commercial and service facility, but it is more organized than typology 1
4		Location : North side of the BRI Tower. It is form as cul de sac corridor, and relatively unorganized.

CONCLUSION

The result of this research submits that Basuki Rahmat street are mostly composed of high-rise building which result the adaptation of its public space, reflecting the user behavior pattern upon its unique corridor. There is relation and linkage between the public space and the high-rise building at Basuki Rahmat corridor.

REFERENCES

[1] Traffic Jam Evaluation[online] Available : http://jatim.tribunnews.com/2012/02/27.

[2] RTRW Surabaya, 2010-2030.

[3] Worker Health Evaluation. [online] Available : http://kesehatan.kompasiana.com/alternatif/2013/01/18/14.

[4] Perda kota Surabaya No 7 Tahun 1992.

[5] Lynch, Kevin. *The Image of The City*. The MIT Press, 1960.

PVDF/TiO_2/PEG Hollow Fiber Membrane for Oily Wastewater Treatment at Various Concentration of Oily Wastewater

Fithri Yatul Humairo[1], Chi Siang Ong[2], Nurul Widiastuti[1], Ahmad Fauzi Ismail[2], Shabrina Adani Putri[1], and Juhana Jafar[2]

Abstract-The purpose of this research is to enhance the performance of PVDF/TiO_2 membrane particularly permeate flux in the application of oily wastewater treatment by adding Polyethylene glycol (PEG). Various concentration of oily wastewater was conducted in order to investigate the influence of the concentration on the membrane performance. Results show that by adding the PEG into the PVDF/TiO_2 membrane, the permeate flux of oily wastewater was increase compared to PVDF/TiO_2 membrane without PEG. The permeate flux was affected by concentration of synthetic oily wastewater. Increasing the concentration of synthetic oily wastewater, decreasing the flux of oily wastewater.

Index Terms-Oily wastewater, Hollow fiber membrane, Polyvinylidene fluoride (PVDF), Titanium dioxide (TiO_2), Polyethylene glycol (PEG).

INTRODUCTION

Increasing number of car and motor vehicle in big city such as Surabaya, generates increasing number of automobile service station and car washing. This cause the increasing amount of oily wastewater release from the automobile service station and car washing. Nowadays, automobile services station and car washing produced oily wastewater up to 4.000 L with concentration of 86-159 ppm [1]. Commonly, the oily wastewater was discharged directly without treatment and caused closed supplied oxygen in the land and pollute soil microorganism. According to the Minister of Environmental regulation number 5 of 2014 concerning waste water quality standards stating that the waste can be disposed of directly must have the oil and fat content of at most 10 ppm. Therefore, that problems need to be solved.

Membrane technology could be the most efficient method to treat oily wastewater compared to biological treatment constructed in wetlands and dissolved air flotation. Previous research reported that PVDF/TiO_2 hollow fiber membrane has been applied for oily wastewater treatment with permeate flux 43,21 L/m^2.h and rejection coefficient 98,28% [2]. It will be better if the permeate flux can be improved further. Polyethylene glycol is an additive membrane that has an impact on enhancing the permeate flux by creating larger membrane pores and keeping membrane resistance from external factor [3].

This research aims to improve the performance of PVDF/TiO_2 membrane by adding PEG and investigate the influence of oily wastewater concentration on the performance of the membrane.

MATERIAL AND METHODS

Material used for membrane matrix was PVDF (Kynar®740) pellets purchased from Arkema Inc., Philladelphia, USA. Solvent to dissolve the PVDF was N,N-dimetylacetamide (DMAc) from Merck. Polyethylene glycol (PEG-400) was purchased from Orec, Titanium dioxide (TiO_2) (Degusa P25) was purchased from Evonik. TiO_2 has BET surface area 50 m^2/g and average particle size ~21 nm with energy band gap 3,18 eV. The oily wastewater was synthesized from lubricant, Enduro Racing 4T SAE10W-40 Pertamina. Other materials used were glycerol and epoxy resin.

Fabrication of hollow fiber membrane begins with preparing dope solution by adding PVDF into DMAc solvent after being dried in the oven for 24 hours to remove pollutant. PEG and TiO_2 were added into the dope solution and mechanically stirred at 600 rpm until the solution completely dissolved form coagulant. The dope solution was then ultrasonicated to remove any bubbles. The hollow fiber membrane was fabricated using dry-jet wet spinning method, then immersed in coagulation bath, for 2 days to removal residual solvent. In third days, hollow fiber membrane was immersed in 10% glycerol for minimizing fiber shrinkage. Finally, hollow fiber membranes were dried at room temperature [4].

The hollow fiber membranes were potted into tube as a module, before placed in the photocatalytic membrane reactor as shown in Figure 1. The membrane was then tested to treat the synthetic oily wastewater.

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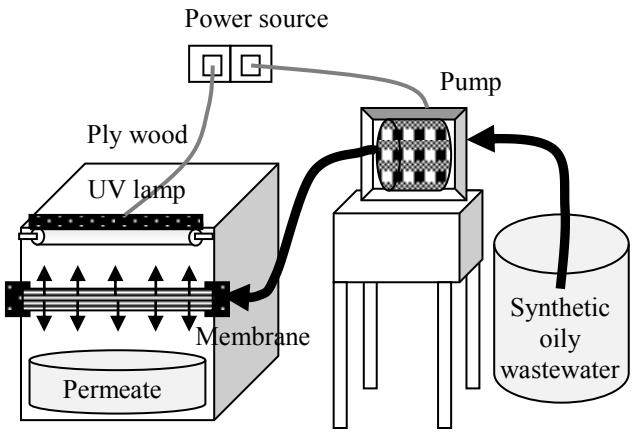

Figure 1. Photocatalytic Membrane Reactor.

RESULTS AND DISCUSSION

The PVDF/TiO_2/PEG hollow fiber membrane was successfully fabricated by dry-jet wet spinning method. Hollow fiber membranes were characterized and results shown in Table 1.

TABLE 1. THE CHARACTERISTICS OF PVDF/TiO_2/PEG HOLLOW FIBER MEMBRANE

Characteristics	Value
Porosity membrane	78,86 %
Contact angle goniometer	69,86^o
Tensile mechanic strength	1,71 MPa
Pure water flux	67,37 L/m^2.h

The morphologies of PVDF/TiO_2/PEG hollow fiber membrane shown in Figure 2,

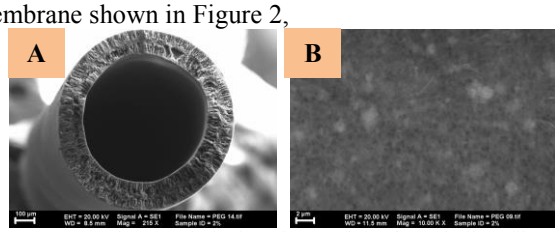

Figure 2. The Morphologies of PVDF/TiO_2/PEG hollow fiber membrane (A) cross section; (B) outer surface.

Performance of PVDF/TiO_2/PEG hollow fiber membrane for treating synthetic oily wastewater at 90 ppm, 125 ppm and 160 ppm was shown in Figure 3,

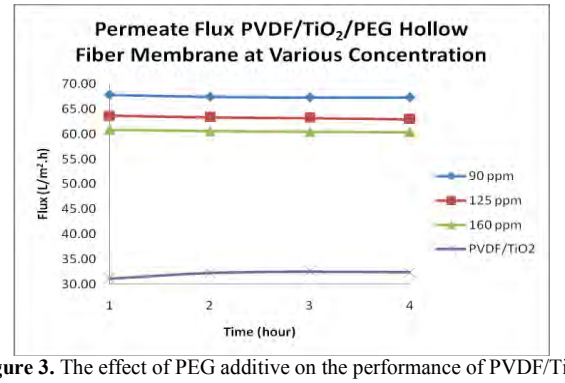

Figure 3. The effect of PEG additive on the performance of PVDF/TiO_2 and the effect of oily wastewater concentration on the flux.

CONCLUSION

PEG as an additive membrane has an impact on enhancing significantly the performance of PVDF/TiO_2 hollow fiber membrane such oily wastewater flux. Increasing the concentration of synthetic oily wastewater, decreasing the flux of oily wastewater.

REFERENCES

[1] Priyanti, P. A. R., "Pengolahan Air Limbah Pencucian Mobil dengan Reaktor Pemisah Minyak dan Karbon Aktif"

[2] Teow, et, al, "Preparation and characterization of PVDF/TiO_2 mixed matrix membrane via in situ colloidal precipitation method", *Journal of Desalination*, vol. 295, pp. 61 – 69, 2012.

[3] Saljoughi et al, "Effect of PEG additive and coagulation bath temperature on the morphology, permeability and thermal/chemical stability of asymmetric CA membranes," *Journal of Desalination*, vol. 262, pp. 72 – 78, 2010.

[4] Ong et al, "Preparation and characterization of PVDF-PVP-TiO_2 composite hollow fiber membranes for oily wastewater treatment using submerged membrane system," *Desalination and Water Treatment*, pp. 1 – 11, 2013.

The Effects of Mechanical Milling and Nb-Based Additives on the Kinetics Sorption Properties of $2LiBH_4$-MgH_2

Farhanah Marwan[1], Raphaël Janot[2], and Jean-Noël Chotard[2]

Abstract – In this work, the effects of ball milling with different catalysts (including NbF_5 and Nb_2O_5) on the hydrogen storage properties of $2LiBH_4$-MgH_2 system were investigated. The increase of ball-milling time (from 5 min to 24 h) can reduce the crystallites size of MgH_2 from 74 nm to 14 nm and decrease the dehydrogenation temperature of MgH_2 from 390°C to 345°C. Among Nb-based catalysts, sample with NbF_5 shows slightly better sorption kinetics than the one with Nb_2O_5, it can store reversibly about 9 wt.% of H_2 in 24 h at 350°C, whereas more than 60 h are needed with Nb_2O_5. This indicates that NbF_5 is superior to Nb_2O_5 for improving the sorption kinetics of $2LiBH_4$-MgH_2 system.

Index Terms – Ball milling, Catalysts, Hydrogen storage, Magnesium hydride.

INTRODUCTION

One of the most promising metal hydrides as hydrogen storage material is magnesium hydride (MgH_2). MgH_2 has very good properties for hydrogen storage, such as high gravimetric (7.6 wt.%) and volumetric hydrogen capacity (110 g/l) [1]. However, MgH_2 requires a high temperature of 350-400°C for dehydrogenation with slow kinetics and high desorption enthalpy (ΔH=78 kJ.mol^{-1} H_2). Therefore, several strategies have been proposed for solving these issues, one of them is the use of reactant destabilization, such as $LiBH_4$ to form Reactive Hydride Composites (RHCs), $LiBH_4$-MgH_2, which has been proven to be effective to reduce the reaction enthalpy by 32 kJ mol^{-1} H_2 in comparison with pure MgH_2 [2].

Although the reaction enthalpy is lowered, dehydrogenation and rehydrogenation processes still occur at high temperatures with slow kinetics. In this present work, we investigated the effect of mechanical milling and addition of transition-metal-based catalysts (such as NbF_5 and Nb_2O_5) on the kinetics rate of hydrogenation-dehydrogenation of $2LiBH_4$-MgH_2 system.

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MATERIALS AND METHODS

The starting materials of MgH_2 (98%), NbF_5 (99%), and Nb_2O_5 (99.9985%), were purchased from Alfa-Aesar. $LiBH_4$ (95%) was purchased from Acros-Organic. The handlings of all materials were performed in a glove box under a purified argon atmosphere.

One gram of $2LiBH_4$-MgH_2 composite material was mechanically milled with a ball-to-powder weight ratio of 48:1 using a planetary ball-miller Retsch PM 100 with a rotation speed rate of 600 rpm. Different ball milling times were used in this research: 5 min, 1 h, 3 h, 24 h, 36 h, and 72 h. After milling, all the samples were characterized by XRD and DSC. X-ray Powder Diffraction (XRD) experiments were performed using a Bruker D8 Advance diffractometer with Co Kα radiation ($\lambda1$ = 1.788970 Å, $\lambda2$ = 1.792850 Å) equipped with a PSD-VANTEC-1 detector. DSC was performed using a Netzch 204 F1 calorimeter with a heating rate of 10 K/min from 25°C to 500°C under a constant flow of argon in sealed aluminum crucibles.

We have also examined the effects of catalysts addition. NbF_5 and Nb_2O_5 were added to one gram of the $2LiBH_4$-MgH_2 material by 72 h ball-milling with different loadings: 5 wt.% and 10 wt.% for NbF_5; and 10 wt.% for Nb_2O_5. To be able to conclude about the most efficient catalyst (i.e. the one leading to the best kinetic rates), we have recorded the absorption-desorption kinetics curves for all samples at different temperatures: 250°C, 300°C, and 350°C. Typically, absorption was performed under a pressure of about 50 bars, whereas desorption was conducted with pressure always kept below 0.5 bar using a Hy-Energy PCT-Pro 2000 volumetric apparatus.

RESULTS AND DISCUSSION

The effect of ball-milling time on the hydrogen storage properties of $2LiBH_4$-MgH_2 system can be seen in Figure 1. The crystallite size of MgH_2 and desorption temperature of MgH_2 were collected respectively from XRD data using the Scherrer equation and from DSC curves. We can clearly see that the increase of ball milling time (5 min to 24 h) leads to a strong decrease of MgH_2 crystallites size from 74.4 nm to 14 nm and reduces the desorption temperature of MgH_2 from 390°C to 345°C. The reduction of crystallites size allows a shortening of

the hydrogen diffusion distance into the solids, therefore leads to a faster hydrogen release. However, with a ball-milling time of 72 h, the desorption temperature of MgH_2 is higher with a peak at 367°C. This could be related to a strong agglomeration of the crystallites as proposed by Yuan et al [3].

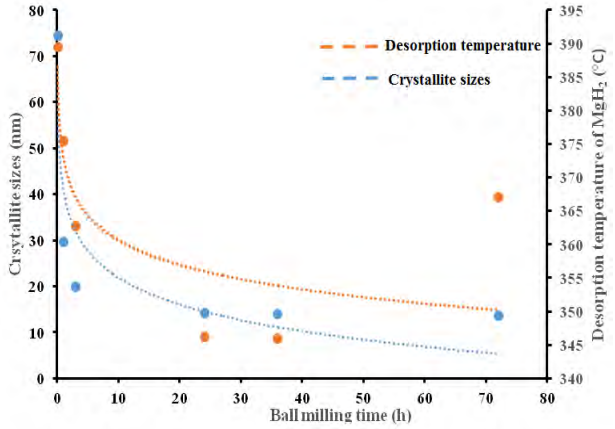

Figure 1. Correlation between ball-milling time, MgH_2 crystallites sizes and desorption temperature of MgH_2.

The addition of Nb-based catalysts into the $2LiBH_4$-MgH_2 system has been done in order to improve its hydrogen sorption properties. In Figure 2, the absorption kinetics for both 5 wt.% and 10 wt.% NbF_5 loadings are very similar highlighting the fact that a large amount of NbF_5 is not needed to get fast kinetics. Obviously, the sorption kinetics are faster at 350°C than those at 300°C with about 9 wt.% of hydrogen reversibly stored within 24 h.

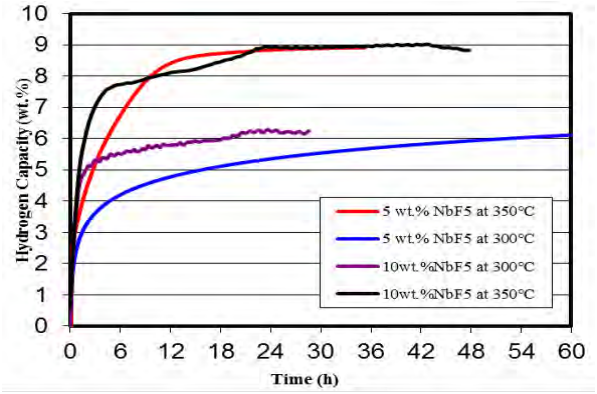

Figure 2. Kinetic curves of absorption of 72 h ball-milled $LiBH_4$-MgH_2 +5wt.% or 10 wt.% NbF_5.

Under the conditions used, the sample doped with NbF_5 shows slightly better adsorption kinetics than Nb_2O_5 (cf. Figure 3). The NbF_5-catalyzed mixture absorbs about 9 wt.% of H_2 in 24 h, whereas the Nb_2O_5-catalyzed mixture takes more than 60 h. This indicates that NbF_5 is a little bit superior to Nb_2O_5 for improving the kinetics of $2LiBH_4$-MgH_2 system.

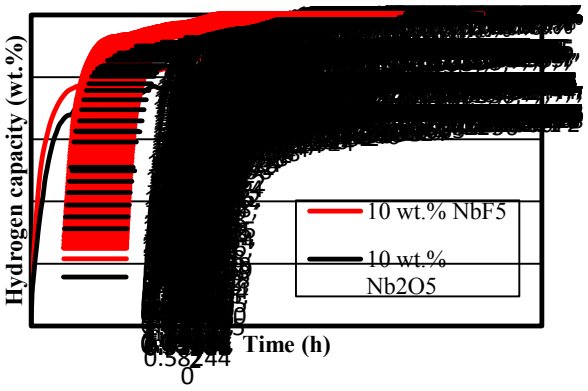

Figure 3. Kinetic curves of absorption of 72 h ball milled $2LiBH_4$-MgH_2 +10 wt.% NbF_5 or 10 wt.% Nb_2O_5 at 350°C.

REFERENCES

[1] House, Stephen D, et al., "Effect of ball-milling duration and dehydrogenation on the morphology, microstructure and catalyst dispersion in Ni-catalyzed MgH_2 hydrogen storage materials". *Acta Materialia*, vol. 86, pp 55-68, 2015.

[2] Vajo, John.J, et al., "Reversible storage of hydrogen in destabilized $LiBH_4$". *The Journal of Physical Chemistry Letters* vol. 109, pp 3719-3722, 2005.

[3] Yuan, Huajun, et al., "Hydriding behavior of magnesium-based hydrogen storage alloy modified by mechanical ball-milling. *Materials Chemistry and Physics* vol. 83, pp 340-344, 2004.

Characteristics of Fishermen Communities in The Coastal of East Balikpapan

Tiara Irawanti[1], Eko Budi Santoso[1], and Haryo Sulistyarso[1]

Abstract - This study aims to identify the characteristics of fishermen communities in coastal areas of East Balikpapan. This type of research is descriptive method, with the technique of observation and questionnaire. This study use proportional sampling of Manggar and Manggar Baru village. The results showed that the fishermen community still using simple tools to catch fish, difficulties in obtaining capital, and fishes catches are sold directly to the retainer or to the market, so that fishermen are not getting the added value production. By knowing the characteristics of fishermen communities are expected to give a discourse in the development area so as to improve the welfare of fishermen in the area of research.

Index Terms – characteristics of fishermen, fisheries, East Balikpapan.

INTRODUCTION

Eastern region of Balikpapan city is the one of the largest fish producer in the Balikpapan city, because its position of the waters directly opposite the Makassar Strait (Irawan, 2006). The magnitude of the fisheries sector caused most of the population have a livelihood as a fisherman. However, during this outcome capture fisheries not already have economic added value, because the catch is marketed directly without being processed so that the benefits of the fisheries sector is not the maximum (Suharto, 2012).

Revenue from the sea is the main source of income for fishermen and is only able to meet the needs of everyday life. This study aims to identify the characteristics of fishing communities in coastal areas Balikpapan District of East.

METHODS

This research type is descriptive conducted to determine the factual description of the characteristics of fishermen communities in East Balikpapan. The population in this study is fishermen community in the Village Manggar and Manggar Baru village of East Balikpapan, while the number of samples used were 96 fishermen. Data collection was performed by the method of observation, and questionnaires.

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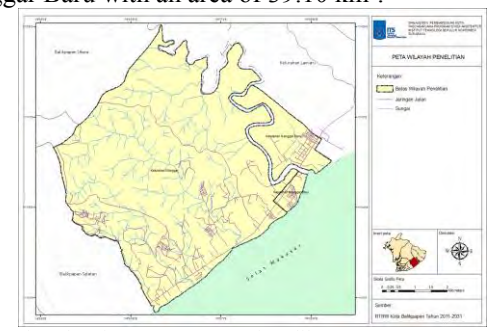
This study use descriptive analysis technique, where the data obtained is described based on conditions seen in the field, so it can be inferred the existence of objects theoretically and produce a recommendation for the development of the research area.

FINDING AND ARGUMENTS

East Balikpapan sub-district has an area of 132,16 km^2, or approximately 26,25% of the area of the Balikpapan, which consists of 4 (four) villages, are Manggar, Manggar Baru, Teritip, and Lamaru. In this study, the research area is limited to Manggar and Manggar Baru with an area of 39.10 km^2.



Source: City Planning Documents Of Balikpapan 2011-2031
Figure 1. The administrative area of research.

East Balikpapan has a fishing village. Fishing settlement or commonly referred to as a fishing village located around Fish Landing Base (PPI) Manggar. Most of the residents are from Bugis and Madura race. For the pattern of settlement, settlement of fishermen was formed by spreading and irregular. As for the typology of the building is divided into 2 (two), which is building on water (floating), and building on land.

Figure 2. Fishing Settlement

Supporting facilities of fisheries activities located in the research area is fish landing bases (PPI), and the base station fuel fishermen. For fisheries production, according

to data from the Department of Agriculture, Marine Affairs and Fisheries in Balikpapan, noted that fisheries production in East Balikpapan in 2013 amounted to 3.816,90 tons and reached a value of 55.119.831.000 rupiahs. Fishing tool most used by fishermen East Balikpapan is a type of fishing (Department of Agriculture, Fisheries, and Marine of Balikpapan City, 2015). As for the fishing boats used in 2013, consists of a boat without a motor 8 units, and motor boats <5 GT as many as 543 units, 5-10 GT as many as 256 units, 10-20 GT as many as 23 units, 20-30 GT 3 units, and >30 GT 2 units.

Based on the results of the questionnaire, obtained some description of the actual conditions on the characteristics of fishing communities, namely:

1) Fishermen's income

The majority of fishermen amounted to 81% of the total respondents had an average income ranging from Rp 1.000.000 - Rp 3.000.000 per month. While the remaining 19% have an average income <Rp 1.000.000 per month. Most respondents found the magnitude of such revenues is uncertain, due to the amount of their income is affected by the number of catches produced.

2) Education level

70% of the total number of respondents have primary education level. While those with middle and high school education that is equal to 16% and 14%. The low level of education of fishermen because they were young when generally prefer to work and help their parents, so it is not too concerned with formal education.

3) Fishing skill

59% of the total number of respondents gain knowledge or skills on fishing techniques is from a family that is also a fisherman. While the rest of 41% gain knowledge about the fishing techniques of learning itself is self-taught with the example of fishing techniques that already exist.

Based on the speaker, choose to work as a fisherman because once the parent is also a fisherman. So that knowledge is also derived from techniques handed down by parents.

4) Capital

Based on the number of respondents who did not get funding to mention that they are difficult to obtain capital relief due to lack of guarantee, so that if there is financial aid that comes from retainer loans and debt collectors.

5) Fishermen group

Based on a primary survey, there are some groups of fishermen who are in East Balikpapan, namely the self-help groups of fishermen, partnerships with the private sector and government-owned fishing groups.

6) Marketing

88% of the total respondents stated that the results of fisheries production is sold to middlemen / retainer, while the remaining 12% of the total respondents stated that the results of its own fish catch is sold directly to the market.

CONCLUSION

The result of this research submits that the fishermen community still using simple tools to catch fish, amounted to 81% had an average income Rp 1.000.000 – Rp 3.000.000 per month and that income olny for the needs of everyday life, fishermen had difficulties in obtaining capital because lack of guarantee, and most of fishermen sell the fishes directly to the retainer or to the market without first processing.

REFERENCES

[1] Irawan, Aditya and Lily Indera Sari. 2006. *Karakteristik Distribusi Horizontal Parameter Fisika-Kimia Perairan Permukaan di Pesisir Bagian Timur Balikpapan*. Journal Ilmu Perikanan Tropis Vol. 18 No.2 April 2013. Samarinda: University of Mulawarman.

[2] Suharto, Rachmad Budi. 2012. *Keuntungan Maksimum Usaha Nelayan di Kecamatan Balikpapan Timur*. Samarinda: Forum Ekonomi Vol. XV No. 2 Juli 2012.

[3] Department of Agriculture, Fisheries, and Marine of Balikpapan City. 2015.

Spatial Modelling Of Religious Tourism Development Strategy with Special Reference of Aer Mata Cemetery Bangkalan Madura, Indonesia

Katherine E.D.P Permanasari[1], Endang Titi Sunarti Darjosanjoto[1], and Murni Rachmawati[1]

Abstract – The development of tourism in Indonesia can be classified based on the type of tourism attraction preferred. Bangkalan Regency determine religious tourism as a major tourism destination. This is as affected by the existence of a number of historical relics which are related to the spread of Islam on Madura Island. , It also asserts this Cemetery as urban heritage that must be protected in Bangkalan. This study explores Cemetery Aer Mata, this religious tourism destination layout has not been arranged properly. For this reason, formulation of the zone mapping in the area is needed, in order to be developed as tourism destination that contains a historical value and consistent with regional policy for conservation. An spatial modeling can be develop as tourism strategy by using cognitive mapping techniques.

Index Terms- cultural heritage, cognitive map, religious tourism, spatial modelling

INTRODUCTION

Aer Mata Cemetery or Pesarean Aer Mata is located in Arosbaya, Bangkalan Regency. It's also known as one of religious tourism destinations in Bangkalan. Cemetery Aer Mata is a cemetery area where the kings and their descendants of Kraton Bangkalan are buried. It has become a sacred place among Madura societies. Cemetery Aer Mata is listed as a cultural heritage conservation area by the attractiveness of cemetery including the beauty of terraced hillside cemetery. The design contains three beliefs influence from Islam, Hinduism, and Buddhism. The combination of these three beliefs produces a unique and great architectural style. It also asserts this Cemetery as urban heritage that must be protected in Bangkalan.

So far this religious tourism destination layout has not been arranged properly. It becomes a great problems for the visitors who visited Aer Mata Cemetery. As a public spaces and one of the famous tourist attraction, this cemetery must be develop to revive the existing cemetery and conserve the heritage area with regulation.

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Figure 1. The Outer Gateway To The Aer Mata Cemetery In Arosbaya, Bangkalan.

For this reason, formulation of the zone mapping in the area is needed, in order to be developed as tourism destination that contains a historical value and consistent with regional policy for conservation. Thus, the research purpose of this paper is to formulate the tourism development strategy by using spatial modeling.

METHODS

The research method applied to the study was descriptive qualitative. It discussed existing data of Cemetery Aer Mata related to the spread of tourism attractions, circulation diagrams (flow) of visitors, accessibilities, and the supporting facilities for tourism activities. The data was presented and analyzed by using cognitive mapping techniques..

FINDING AND ARGUMENTS

The aim of this research is identify and analyze existing condition of Aer Mata Cemetery. This Cemetery consists of two areas, there are private area and public area. The private area contains the cemetery cluster in three levels, museum, mosques and security shelter to help the visitors and guide them around cemetery area. The public area contains several public facilities such as parking area, art market, shelter, and the main gate. By identify the existing data, we can identify some potentials spot which can be develop or can be maintain as the tourist attraction.

After that, we classify all information with the cognitive mapping techniques, information such as circulation, the spread of tourism attractions, accessibilities, and the supporting facilities. All the information will be trace to graphic data that consist of

main map (Aer Mata cemetery map), key plan, and also layout explanation.

Figure 2. sample of cognitive mapping data explaining the accesibilities around aer mata cemetery in arosbaya.

The sample of cognitive mapping describes a brief explanation about the problems such as the crossing spot because the visitors circulations has not been arranged properly, other problem such as the damaged of supporting facilities, a blank spot, and potential tourist attractions. The brief explanation about the Aer Mata Cemetery can be developed as the development strategy of Aer Mata Cemetery as religious tourism object.

Figure 3. Sample of cognitive mapping data explaining the CROSSING SPOT around aer mata cemetery in arosbaya

CONCLUSION

Spatially, the outcome of this research is a strategy to determine potential spots in Aer Mata Cemetery.. This potential spots hopefully can be used as spatial solution to settle existing problems and increase tourism value. Further, this solution represented as spatial modelling of Aer Mata Cemetery.

ACKNOWLEDGEMENTS (OPTIONAL)

If you wish to identify funding sources or significant contributions by others, please include your acknowledgements at the end of your extended abstract but before the References. Only include this information on the final camera-ready copy

REFERENCES

[1] Bridgwood, Barry, Lennie Lindsay, (2009) History, Performance and Conservations. New York: Taylor &Francis.

[2] Gupta, Akhil dan Ferguson, (1997). Culture, Power, Place: Explorations In Critical Anthropology, London: Duke Unversity Press.

[3] Budiharjo, Eko, dan Sidharta, (1989). Konservasi Lingkungan dan Bangunan Kuno Bersejarah di Surakarta. Yogyakarta: Gajah Mada University Press.

[4] Darjosanjoto, Endang Titi. (2012). Penelitian Arsitektur dibidang Perumahan dan Permukiman. Surabaya : ITS Press.

[5] Pemerintah Kabupaten Bangkalan. (2006). Rencana Tata Ruang Wilayah Kabupaten Bangkalan tahun 2009-2028.

3D Seismic Tomography Imaging of Taiwan Substructure

Susi Anggraini Diah Ningrum[1] and Bagus Jaya Santosa[1]

Abstract-Taiwan has a high rate of crustal deformation and a strong seismic activity. Taiwan is located on the convergent boundary between the Eurasian and the Philippine Sea plates. Seismic tomography is an imaging technique that uses seismic waves to create three-dimensional images of Earth's interior. We use the earthquake of M > 4.7 and occurred in the period of 1 January 2009 to 31 December 2010. The data processing steps of seismic tomography are picking of P and S wave using SeisGram2K60, hypocenter relocation using Hypo71, and tomography inversion using LOTOS-12. The result shows that there is high Vp and Vs in the eastern Taiwan that represent the western boundary of Philippine Sea Plate with Longitudinal Valley.

Index Terms - Earthquake, Taiwan, relocation, tomography.

INTRODUCTION

Taiwan has a high rate of crustal deformation and a strong seismic activity, and many disastrous earthquakes have occurred in the past [1]. In the 20th century, disastrous earthquakes in this region have caused great damage to properties, as well as to human lives [2]. With large number of earthquakes in and around Taiwan, it is thus important to analyze the seismic velocity structures under Taiwan Island to recognize background seismicity in the Taiwan region for the purposes of future earthquake hazard evaluation. A technique to develop images of individual slices through the deep Earth called seismic tomography. Seismic tomography is one of the main techniques to constrain the three-dimensional (3-D) distribution of physical properties that affect seismic-wave propagation: elastic, anelastic, and anisotropic parameters, and density. Tomography images show the detail of velocity structure under Taiwan.

METHODS

In this study, the data is downloaded from IRIS catalog. The selection of earthquakes was based on the following criteria: (1) earthquakes occurred in the period from 1 January 2009 to 31 December 2010; (2) the events have magnitude M> 4.7; (3) the events recorded by 7 stations of Broadband Array in Taiwan for Seismology (TW).

Pick all the arrival time of P and S wave manually using SeisGram2K60 software and re-determine locations of earthquake using HYPO71. The P and S wave arrivals time, latitude, longitude, depth, and a one-dimensional (1-D) horizontally layered P wave velocity model were used as input of Hypo71 for hypocenter relocation.

LOTOS-12 was used for our 3-D Vp, Vs, and Vp/Vs inversion. The LOTOS code is a ray tracing algorithm based on the Fermat principle of travel time minimization. After 1-D velocity model and the preliminary location of the source is known to the optimization of 1-D models, then do relocation with 3-D ray tracing, then the next step is use a gradient method to obtain the location of the source in the 3-D model. Parameterization method using nodes. Overall matrix inversion to be obtained by using the iterative LSQR. Iteration can be repeated in order to get the best results. In order to reduce the effect of node distributions on the results, we perform the inversion using several grids on a horizontal plane. In depth, a total of 9 grid points are distributed at depths of 9, 13, 17, 21, 25, 30, 35, 50, and 70 km.

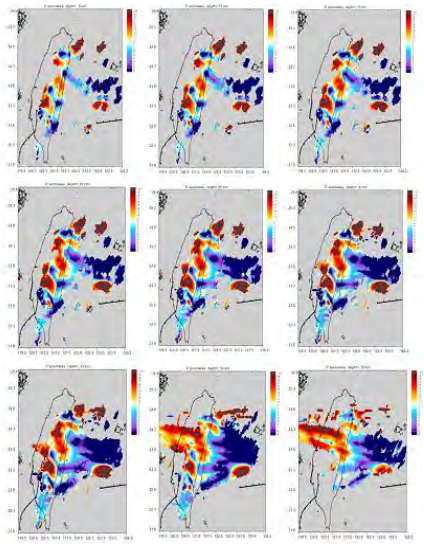

Figure 1. Anomalies distribution of Vp at 9 different depths. Red and blue shows low and high anomalies, respectively.

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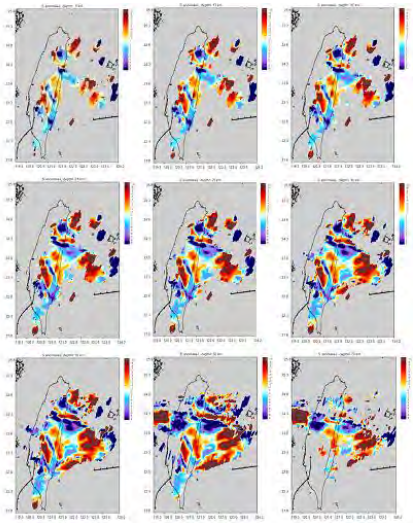

Figure 2. Anomalies distribution of Vs at 9 different depths. Red and blue shows low and high anomalies, respectively.

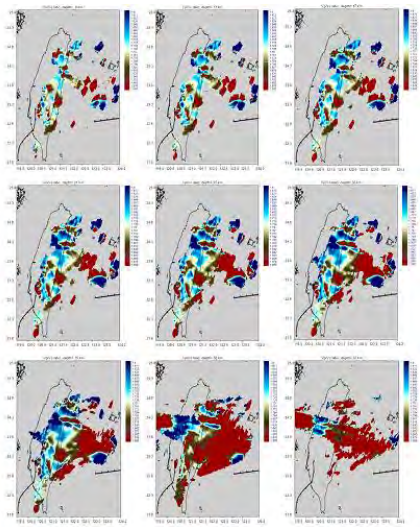

Figure 3. Vp/Vs perturbation maps at nine different depths. Blue and red show high and low velocity, respectively.

RESULT AND DISCUSSION

The 3-D Vp structure from our inversion largely agree with that obtained in previous studies [1] [3]. Figure 1, in shallow depth (<10 km deep) was found the negative anomaly of Vp and Vs, low Vp/Vs that are associated with Neogene sedimentary rocks in the Western Foothills.

Negative anomaly of Vp and Vs also found in the northern part of Taiwan at the depth of 9 km to 35 km. It is agree with [3] that show the negative anomaly is probably related to the Tatun and Chilungshan volcanic groups. Reference [4] showed that the active volcanic regions are generally underlain by low-velocity zones. A low-velocity zone in the northern part of Taiwan is probably related to this geothermal effect, which reduces the P wave velocity.

Figure 3 show high Vp/Vs was found in Coastal Range at the depth of 13 km to 30 km that indicate fluids in the crust at depth, possibly along the major fault zones of the suture, Longitudinal Valley.

Longitudinal Valley is suture zone between Central Range and Coastal Range. Figure1 and Figure 2 show a very sharp boundary between high and low Vp coincides with the Longitudinal Valley in eastern Taiwan. High Vp and Vs to the east of this boundary clearly reflects the oceanic crust of the Philippine Sea plate. The Central Ranges west of this boundary, however, has much lower Vp. This indicates clearly that a fundamental material difference exists between the oceanic Philippine Sea plate and the basement of the Central Ranges.

Along the Ryukyu trench is dominated by positive anomaly of Vp and high structure of Vp/Vs that indicates the high seismicity in this region. The different pattern of P-wave and S-wave images in this zone suggests that the resolution of S-wave is lower than that of P-wave due to less reading of S arrivals.

CONCLUSION

The eastern part of Taiwan was dominated by positive anomaly of Vp and Vs reflect the west boundary of Philippine Sea Plate with Longitudinal valley as a suture zone. The negative anomaly of Vp and high seismicity in Central Range was correspond to active fault zone, Lishan Fault. This anomaly may indicate heat intrusion from the Philippine Sea plate. Negative anomaly of Vp and Vs, low Vp/Vs that show Western Foothills is consist of Neogen sedimentary rock. High Vp/Vs in Central Range correspond to large amount of young sediments, active fault zone, and may indicate fluids there.

REFERENCES

[1] Y. M. Wu et al., "Seismic tomography of Taiwan: Improved constraints from a dense network of strong motion stations," *Journal of Geophysical Research*, vol. 112, no. B08312, pp. 1-14, 2007.

[2] J. Zhuang et al., "A study on the background and clustering seismicity in the Taiwan region by using point process models," *Journal of Geophysical Research*, vol. 110, no. B05S18, 2005.

[3] K. F. Ma et al., "Three-dimensional seismic velocity structure of the crust and uppermost mantle beneath Taiwan," *Journal of Physics of the Earth*, vol. 44, no. 2, pp. 85– 105, 1996.

[4] H. Hasegawa et al., "Deep structure of arc volcanoes as inferred from seismic observations," *Philosophical Transactions: Physical Sciences and Engineering*, vol. 342, pp. 167-178, 1993.

The SFA-LSSVM as a Decision Support System for Mitigating Liquefaction Disasters

Julian Pratama Putra Thedja[1], Jui-Sheng Chou[1], and Tri Joko Wahyu Adi[2]

Abstract-Advanced data mining techniques are potential tools for solving civil engineering problems. This study proposes a novel classification system that integrates smart firefly algorithm (SFA) with least squares support vector machine (LSSVM). SFA is an optimization algorithm which combines firefly algorithm (FA) with smart components, namely chaotic logistic map, chaotic gauss/mouse map, adaptive inertia weight and Lévy flight to enhance optimization solutions. The least squares support vector machine (LSSVM) was adopted in this study for its superior performance of solving real-world problems. Based on the provided engineering data, the analytical results confirm that the SFA-LSSVM has 95.18% prediction accuracy.

Index Terms - Data mining, optimization, firefly algorithm, support vector machines, liquefaction.

INTRODUCTION

Existence of soil liquefaction when earthquake happens is one of the critical issues in geotechnical engineering. Liquefaction can be defined as the transformation of a granular material from a solid to a liquefied state because of increased pore-water pressure and reduced effective stress. For example, in water saturated sand, the sand grain packed together. However, between each of sand grain, there is a body of water known as pore water. As the sand vibrates, it shifts. The water under pressure then pushes the sand grains apart. Therefore, sand grains are no longer wrestling together and no longer stable. This phenomenon is usually caused by earthquake and greatly reducing soil effective stress that leads to losses bearing capacity of a foundation.

A least squares support vector machine (LSSVM) is an AI algorithm based on Statistical Learning Theory. The LSSVM is now recognized as an excellent AI algorithm and has been widely used due to its advantages in many fields. However, the performance of LSSVM depends on the selection of penalty parameter (C) and kernel parameter (σ). Both of LSSVM parameters known as LSSVM hyperparameters. Optimization of LSSVM hyperparameters avoids over-fitting, avoids local minima problems, and improves prediction accuracy. Some researcher has proven modified firefly algorithm combined with LSSVM is better than other hybrid algorithms. A chaotic firefly algorithm for optimizing the LSSVM hyper-parameters performs better than other algorithms [1]. Thus, the chaotic firefly algorithm is further improved by combining it with new smart components, namely adaptive inertia weight and Lévy flights in this study.

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METHOD

A. Least Squares Support Vector Machine

The support vector machine (SVM) was originally developed by Vapnik et al. in 1995 [2]. The SVM has been widely used for classification because of its high learning capabilities. An SVM performs classification by constructing an N-dimensional hyperplane that optimally separates the data into two categories. The main idea of SVM is to find the largest margin between two categories. The least squares version of support vector machines (LSSVM) classifiers is close to conventional SVM formulation. Alternatively, it solves linear problems, not quadratic programming problems [3]. This algorithm applies a least squares cost function to obtain a linear set of equations in the dual space by modifying the conventional SVM as shown in Eqs. (1) and (2):

$$L = \frac{1}{2}\|\vec{w}\|^2 - \frac{1}{2}C\sum_{i=1}^{N} e_i^2 \quad (1)$$

Subject to the equality constraint

$$y_i(\vec{w_i} \bullet \vec{x_i} + b) = 1 - e_i \quad (2)$$

The LSSVM method is attractive because it has a low computational cost compared to the conventional SVM and is as accurate as the conventional SVM. The LSSVM with RBF kernel already proved its performance by solving a two-spiral classification problem, which is known to be hard for multilayer perceptron [4]. The LSSVM also uses all samples to find a good approximation model. Therefore, LSSVM is widely used to solve real-world problems.

B. Swarm and Evolutionary Optimization Algorithm

The firefly algorithm (FA) developed by Yang is based on the flashing patterns and behavior of tropical fireflies [5]. Equation (3) gives the movement of the j^{th} firefly when attracted to another more attractive (brighter) k^{th} firefly at x_j and x_k, respectively.

$$x_j = x_j + \beta_0 e^{-\gamma r_{jk}^2}(x_k - x_j) + \alpha_0(rand - 0.5) \quad (3)$$

The FA parameters are fixed and do not change during iterations. However, an important component in swarm intelligence and modern meta-heuristics is the use of randomization to enable an algorithm to jump out of any local optimum during a global search. Fine-tuning the randomness and balance of local search and global search are essential for controlling the performance of any meta-heuristic algorithm. Thus, FA must be incorporated with other components to enhance FA performance. In this study, chaotic Gauss/Mouse map is used to fine tune β_0 parameter, chaotic Logistic map is used to diversify the FA initialization, adaptive inertia weight is used to maintain α_0 in a reasonable range, and Lévy flight is used to increase optimization capability of FA by mimicking the movements of insects.

CASE STUDY AND DISCUSSION

The historical data set was recapped by Goh and Goh [6]. The 226 cases in the soil liquefaction database include 133 liquefied cases (class 1) and 93 non-liquefied cases (class 0). The data represents the field performance of 52 sites taken from six different earthquakes. The six input variables considered were the cone tip resistance (q_c), the sleeve friction ratio (R_f), the effective stress at the depth of interest (σ'_v), the total stress at the same depth (σ_v), the maximum horizontal ground surface acceleration (a_{max}), and the earthquake moment magnitude (M_w).

Table 1 shows that the proposed model can predict soil liquefaction existence with 94.31% accuracy in average. Using feature scaling increases accuracy to 95.18%. Notably, the TACO-miner algorithm [7] is highly effective for predicting soil liquefaction existence. It predicts soil liquefaction existence with 100% accuracy. Unfortunately, k-fold cross-validation algorithm was not performed to minimize prediction bias in their studies. The accuracy presented in literature may be a one-time luck. Although the proposed algorithm is not as accurate as previous algorithms, its results are relatively reliable based on the 10-fold cross validation.

TABLE 1. COMPARISON RESULTS.

Literature	Technique	Cross fold validation	Accuracy (%)
Goh and Goh, 2007	SVM	-	98.00%
Baykasoglu, 2009	NBTree	-	86.67%
	Decision table	-	93.33%
	PART	-	84.00%
	C4.5	-	90.67%
	MEPAR-Miner	-	97.73%
	TACO-miner	-	100.00%
This study	SFA-LSSVM (original value)	10	94.31%
	SFA-LSSVM (Feature scaling)	10	95.18%

The performance of the proposed SFA-LSSVM system was validated with the actual case to confirm the practicality of a hybrid swarm intelligence system. The SFA-LSSVM has consistent and adequate prediction accuracy compared to previous prediction methods and can be considered as an effective and accurate decision-support system.

REFERENCES

[1] A. Kazem, E. Sharifi, F. K. Hussain, M. Saberi, and O. K. Hussain, "Support vector regression with chaos-based firefly algorithm for stock market price forecasting," Applied Soft Computing, vol. 13, pp. 947-958, 2// 2013.

[2] C. Cortes and V. Vapnik, "Support-vector networks," Machine learning, vol. 20, pp. 273-297, 1995.

[3] J. A. Suykens, T. Van Gestel, J. De Brabanter, B. De Moor, and J. Vandewalle, Least squares support vector machines vol. 4: World Scientific, 2002.

[4] J. A. K. Suykens, "Nonlinear modelling and support vector machines," in Instrumentation and Measurement Technology Conference, 2001. IMTC 2001. Proceedings of the 18th IEEE, 2001, pp. 287-294 vol.1.

[5] X.-S. Yang, "Firefly algorithms for multimodal optimization," in Stochastic algorithms: foundations and applications, ed: Springer, 2009, pp. 169-178.

[6] A. T. C. Goh and S. H. Goh, "Support vector machines: Their use in geotechnical engineering as illustrated using seismic liquefaction data," Computers and Geotechnics, vol. 34, pp. 410-421, 9// 2007.

[7] A. Baykasoğlu, A. Çevik, L. Özbakır, and S. Kulluk, "Generating prediction rules for liquefaction through data mining," Expert Systems with Applications, vol. 36, pp. 12491-12499, 12// 2009.

The Effect of Green Building Application to Property Value

Fitri Rahmawati[1], Christiono Utomo[2], and Purwanita Setijanti[1]

Abstract–The green building concept is one of the solution for the next sustainable development. One of the biggest barriers is the feasibility of financial return. This research is conducted to determine the influence of the green building aspects application towards the property value of high rise building that seen from the design and material aspects in Surabaya. This study, conducted by a survey research using questionnaires for data collection, and regression analysis. There are ten aspects that its use may increase the property value, wich are the horizontal massing design, secondary skin, smart lighting systems, grey-water systems, green roof, lightweight concrete, photovoltaic systems, smart lighting systems, air conditioner with VRV systems, gray-water systems, Low-E glazing, low VOC paint wall, and green roof.

Index Terms – Green building, high-rise, property value.

INTRODUCTION

Buildings represent 32% of total final energy consumption in the world [1] and the largest emitter of carbon in nature, thus the business in the building sector has a responsibility to contribute to reducing carbon emissions. The green building concept is one of the solution for the next sustainable development [2]. One of the biggest barriers to invest in green building is the perception that the cost spent is greater than the conventional buildings, such as an increasing initial investment cost on the building [3].

Building and Construction Authority Singapore (BCA) [4] states that sustainable development becomes a necessity, because it becomes an important green building design. Using green building materials can help improve indoor air quality (IAQ) and satisfy consumer demand. At this time, the property market trend is more receive a product that applies the concept of green, one of the indicators is the market price of the property is higher than the property that do not apply the concept of Green Development [5]. Assets that retain value through higher occupancy and easier maintenance, much easier to sell and has higher market valuation [6]. Indonesia Property Management Association estimate, the green projects bring added value. Rental prices could rise to 6.4 per cent, while the selling price could rise to 19.6 percent [7]. The companies that have image as 'environmentally friendly company' can attract more consumers to buy their products [8].

Veld and Vlasveld [9] examined the effect of sustainability on retail values, rents, and investment performances. The results showed that green retail properties have significantly higher income return. Isaa et al. [10] examined the factors that affect investment in green office building concepts. The results are increase in investment, market and the value of the rent, the cost savings gained from the use of green materials, also beneficial to the surrounding environment and social. The findings of Eichholtz in Falkenbach, et al. [11] describes the increase in property values by comparing rental prices average labeled green buildings compared with surrounding buildings that are not labeled green.

The similarity of this study is the assessment of the property as seen from the green features. The difference is the methods and the end goal, that is to figure out how the impact of green building on the property value.

METHODS

This study is a confirmatory study, conducted during January 2015 until April 2015, with 38 respondents. The selected population is a property developer practitioner that ever and/or directly involved in the high-rise building projects in construction management and property development in the area of Surabaya. The questions have been addressed to the manager upwards to the director. The questions contained twelve aspects green building concepts that related to property value, using Likert scale questions analyze. A preliminary research was done done to obtain green building aspects in design and material aspects before the questionnaire survey to respondents.

The type of method used is nonprobability sampling, with the purposive sampling followed by snowball sampling. Purposive sampling conducted to obtain initial respondents in accordance with the limits and scope of the research. Snowball sampling is used because researchers lack of understanding the scope of the study population.

RESULTS & DISCUSSION

The increasing value of the property in high-rise building related to green building concepts is influenced

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by ten aspects. The empirical model of property value related to green building concepts as shown in Figure 1.

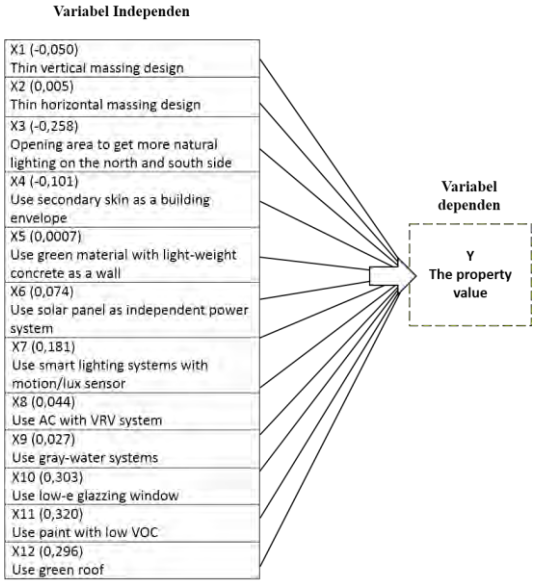

Figure 1. Empirical model of property value.

Figure 1 shown the positive and negative value. The positive value means the effect is in the same direction with the increasing property value. The negative value means the effect is in the opposite direction with the increasing property value. The equation, formula can be explained as in (1), that seen from the empirical model in Figure 1.

$$Y = 0{,}021a - 0{,}05x1 + 0{,}005x2 - 0{,}258x3 + 0{,}101x4 + 0{,}0007x5 + 0{,}074x6 + 0{,}181x7 + 0{,}044x8 + 0{,}027x9 + 0{,}303x10 + 0{,}320x11 + 0{,}296x12 \quad (1)$$

With:
Y = Property Value
a = constants
bx1, bx2,.., bx12 = regression coefficient x1, x2, ..., x12

CONCLUSION

It is concluded that not every aspect in green building can increase the property value. The ten aspects that have positive effects such as the horizontal massing design (X2), secondary skin (X4), the application of lightweight concrete (X5), photovoltaic systems (X6), smart lighting systems (X7), Air conditioner with VRV systems (X8), gray-water systems (X9), Low-E glazing (X10), low VOC paint wall (X11), and the application of green roof (X12). The 2 other aspects gives the opposite effect on increasing property values, such as the vertical massing design (X1) and opening direction area in north – south side (X3).

REFERENCES

[1] International Energy Agency (IEA), Annual Report 2012. [online]. Available: https://www.iea.org/publications/freepublications/publication/IEA_Annual_Report_publicversion.pdf.

[2] E. Piet, Et al. *The Economics of Green Buildings. University of California. Berkeley Program on Housing and Urban Policy*. Working Paper W10-003. 2010.

[3] J. K. Matthew, Investing in A Sustainable World : Why GREEN is The New Color Of Money On Wall Street. New York: Amacom. 2009.

[4] Building and Construction Authority Singapore. The Centre for Sustainable Buildings and Construction, Building and Construction Authority. 2010.

A. Wilson, L. Unchaper, and Rocky mountain Institute. Green Development: Integrating Ecology and Real Estate. Canada: John Wiley & Sons, Inc. 1998.

[5] US Green Building Council. Making The Business Case For High Performance Green Buildings. US GBC Report. Washington. [online]. Available: http://www.usgbc.org/resources/usgbc-2012-annual-report.

[6] Building Owners and Managers Association International. [online]. Available: http://www.boma.org/Pages/default.aspx. 2015.

[7] K. Sam, Green Construction Project Management And Cost Oversight. Oxford: Architectural Press. 2010.

[8] V. Hans and V. Martijn. The Effect of Sustainability on Retail Values, Rents, and Investment Performance: European Evidence. Journal of Real Estate. Vol. 6, No.1. 2014.

[9] Mona, Et al. Factors affecting Green Office Building Investment in Malaysia. Proceeding Asia Pacific International Conference on Environment-Behaur Studies. Procedia: Social and Behavioral Sciences 105, pp.138–14 . 2013.

[10] H. Falkenbach, Et al. Environmental Sustainability: Drivers for the Real Estate Investor. Journal of Real Estate Literature. Vol. 18 Issue 2, p201. 2010.

A Review on User Perception of Desktop and Mobile Service Website Using Webqual and User Experience Approach

Rizqiyatul Khoiriyah[1] and Apol Pribadi Subriadi[1]

Abstract - As the online media dissemination, website has the advantages that it can be accessed freely, without limits, wherever, whoever, and whenever. However, the advantages of the website is sometimes not in line with its simplicity. So it becomes important that the organization can make an assessment of the quality of the website that they are used, whether its website has fulfilled what is perceived by the user. This paper reviews studies user perception of desktop and mobile service website used qualitative methods adapted to WebQual and User Experience approach. The expected outcome of this research is knowing the user's perception of the services and information available on the website along with the possibility of desktop and mobile gap arising from differences in the two services.

Index Terms – Perception, desktop website, mobile website, Webqual, User Experience.

INTRODUCTION

Since it was first introduced in the mid-90s, electronic services have spread across the world in various forms. The growth of the web has made the need for measurements related to quality, such as usability and accessibility of a web application. As a media, website has the advantages to be accessed freely, without limits, wherever, whoever and whenever. But lately, that advantages are no longer in line with the convenience. (Mich et al, 2003)

Some research on the quality of website service had conducted by Parasuraman, et al, (1985, 1988, 1991, 1994), and Zeithaml, et al, (1988, 1996, 2000). Three main models of service quality that developed in this study are Servqual, ServPerf, and e-Servqual (ESQ). A measurement model to assess the other quality component by DeLone and McLean. (DeLone and McLean, 2003). Furthermore, research on service quality began to lead website. The most widely accepted and validated model is WebQual (Barnes and Vidgen, 2000; Loiacono, Watson, and Goodhue 2002). Most of the research object is a website service, namely: e-commerce, e-banking, education and health, firm websites and mobile portals. This provides a good opportunity to further research on the service quality of mobile portal website as it occupies the lowest position. (Farida, et al, 2014).

Some of these studies trigger a research that aims to assess user perceptions that arise from user experience to desktop and mobile website. Users are the key of the success or failure of the program. When the user considers the website hamper their work, so they will not use the website. From here, it can be seen how important for us to know the desires and opinions of the users. Therefore, this study was conducted as a qualitative of website research study to explore and examine more deeply about the analysis of user perception toward services desktop and mobile website.

Based on the background, the question to be answered through this research is "How is the user's perception of the desktop and mobile website services?". For more details, formulation of problem in this research are:

1. Is the user's perception of desktop and mobile website services can be assessed from the *WebQual* dimensions and *User Experience* ?
2. Is there an access gap between the desktop and mobile website ?
3. Is the user perception's analysis on the desktop and mobile website can contribute to the previous WebQual models ?

METHODOLOGY

This study uses a qualitative approach with systems information perspective. Qualitative approach is a process of research and understanding based on a methodology which investigates a social phenomenon and human problems. This qualitative research design refers to the theoretical reference written by John W. Creswell (2014). The problems are identified by using a case study approach aimed to analyze, understand, and explore the quality of the website in desktop and mobile.

Informants were selected based on purposive sampling techniques, meaning that the sample is not intended to represent the population, they represent information. In quantitative research, the samples should be representative on the population and there must also a clear formula of sampling. Then the informants may be limited to essential information that is considered to represent the overall information. (Creswell, 2014). From those qualifications, the selected informants are the website news users

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employed as editor of newspaper "X" who have large interest to get the news and having adequate intensity on visiting website.

TABLE 1. THE DEMOGRAPHICS OF RESEARCH INFORMANTS

Informants = 8	
Age	> 20 years old = 7 < 20 years old = 1
Sex	M = 6 F = 2
Education	S1 = 6 S2 = 2
Length of Employment	> 5 years = 6 ; < 5 years = 2

RESULTS AND DISCUSSION

All interviews and discussions recorded into an audio recorder and notes. The collected answers then be summarized as a further coding. After doing transcription and organizing the data, the researchers start to do coding. Perception analysis in this study uses qualitative data with the following stages: (1) statements of informants; (2) meaningful statement data; (3) identification of the category; (4) a description of the category; (5) grouping of major categories; (6) minor proposition; (7) major proposition.

Identification and description of the categories described the research categories namely: usability, information quality, service interaction from WebQual instruments 4.0 (Barnes and Vidgen, 2002). There are also categories of desktop services (overall), mobile services (overall), and recommendation (user expectations) that are part of the service quality (Parasuraman, 1985).

Results of analysis can explain the relationship the user experience toward WebQual dimensions which is main categories namely : usability , information quality, and service interaction and it is used to evaluate desktop and mobile website services. It answers the previous research (Barnes and Vidgen, 2002; Cheng and Zheng, 2013) to explore the service quality of the website from particular aspect that has been done. This study aiming the website evaluation from the access device via desktop and mobile. It also address the challenges of previous research (Sue Conger, 2012): the need for evaluation and measurement of service quality are in accordance with the development of the website, namely : media access, the website services and so forth.

CONCLUSION

Based on the formulation of the problem, the discussion and the results of the study, then the conclusions are as follows:

1. User perception of desktop and mobile website services can be assessed by following WebQual dimensions. Assessment on dimensions of usability including the ease of website operation, learning the website, finding the address, the attractiveness, organized layout information, design and search features. Assessment on dimensions of the information quality covers accuracy, reliability, up to date, relevance, comprehension of information, information details. Assessment on dimensions of service interaction includes reputation, data security, attractiveness, the contribution of information, the ease to feed back and overall service.
2. Users experience that influence component in each dimension of service quality, namely usability, information quality and service interaction. Results of the user experience is used to answer questions about those dimensions.
3. There are differences lead to disparities, although not so significant between desktop and mobile access websites, there are difference in services are limitations menu option, limited number of links, the difference in layout, thus affecting user interests.
4. Model analysis of user perceptions on desktop and mobile website services can contribute to the models of the previous WebQual :
   a. The discovery of "Trust" as a new part of the dimensions of information quality (external factors: brand image, previous experience, owner of brand communications, media and word of mouth) appeared to affect user perceptions.
   b. At WebQual models, the 6th of usability dimensions (layout tools as appropriate) have similarities with the 7th of information quality dimensions (the information is presented in a suitable format layout). This causes the answer to both dimensions is almost indistinguishable.
   c. Model analysis of the perception of this website service can complement the WebQual models by providing consideration services in the form of access devices that used (desktop and mobile)

FUTURE RESEARCH

Here is a suggestion proposal related to this research and its future development are the object of research is a newspaper company. It is based on their priority interest that they relate directly to the website. Future studies can take gender, education level, location into consideration. Researchers can add focus on the manager of the website for the balance between the user and manager.

REFERENCES

[1] Barnes, S; dan Vidgen, R. 2001. WebQual : *An Exploration of Web-site Quality. Communications Vol. 1, pp. 298–305.*
[2] Creswell, John W., 2014. *Research Design Qualitative, Quantitative, and Mixed Methods Approaches 4th Edition*. Sage Publications Inc. California
[3] Parasuraman, A., Zeithaml, V. A., & Berry, L. L. 1988. *SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality*. Journal of Retailing, 64, 12–40.

Kinect Depth Image Processing for Hand Motion Recognition using Backpropagation Neural Network

Syamsiar Kautsar[1], Purwadi A. Darwito[1], and Sryang T. Sarena[2]

Abstract-Kinect RGB-D Camera is a sensor for human gesture recognition. Kinect has built-in infrared array sensor which produces a depth image data. In this research, the depth image data is used to recognize human hand condition. The depth images of human right hand are processed by normalized central moment method. Furthermore, the moment value of hand depth image is used for backpropagation artificial neural network data training. A great training result is yielded by 70% accuracy. In addition, the output of neural netwok model is used to control a robot hand.

Index Terms – Kinect camera, depth image, neural network.

INTRODUCTION

In this research, a human hand motion recognition[1] system using Kinect RGB-D Camera[2] sensor is offered. This recognition system is used to control a robot hand motion [3][4]. The tracked object does not need to wear any pattern for recognition processing. The depth image of human hand is characterized by moment value. This value is extracted using normalized center moment method[5]. Hereafter, the moment value is processed using backpropagation artificial neural network (BP ANN)[6]. Hand grip condition is represented by the ANN output data. Finally, the result of hand motion recognition is used to put the BuTO robot hand in motion.

MATERIAL AND METHODS

I. The robot hand hardware

The shape and size of the robot hand is conditioned to grasp the objects with a diameter of 10 cm. Figure1 is the result of hardware realization of the robot hand. The robot hand actuators are using standard servo HS-255B model. The motions degree of servos are controlled through ATMega 16 which receives input data from computer via serial communication.

Figure 1. Robot Hand Hardware.

II. The characterization of depth image and BPANN modeling

The results of depth image cropping is based on 3D skeleton data, which then is processed using image clipping method to remove the background and change the grayscale image into bitmap image. The bitmap image is characterized using 1st and 2nd equations. The characterization results are used for ANN data input. In this study, the ANN model has 8 neurons in the 1st hidden layer, 4 neurons in the 2nd hidden layer, and tangen sigmoid as activation function. Figure 2 is an example of the depth image processing for hand motion recognition.

$$M_{ij} = \sum_{x=1}^{M}\sum_{y=1}^{N}(x-\bar{x})^i(y-\bar{y})^j.I(x,y). \quad (1)$$

$$\eta_{ij} = \frac{\mu_{pq}}{\mu^{\gamma}_{00}}, \gamma = \frac{i+j+2}{2} \quad (2)$$

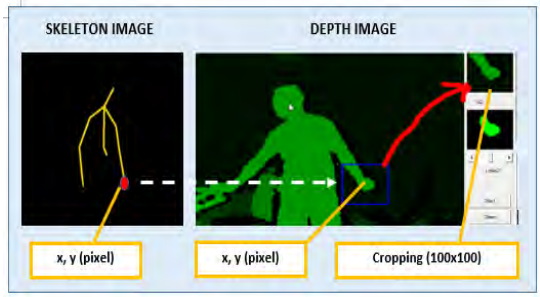

Figure 2. Depth Image Processing.

Each hand condition has different N11, N02, N20, N03, N30, N12, N21 value. The moment values which are processed by ANN represent the human hand condition. The system reads it as opened hand condition if ANN output value < 0.55, and closed hand condition if ANN output value >=0.55.

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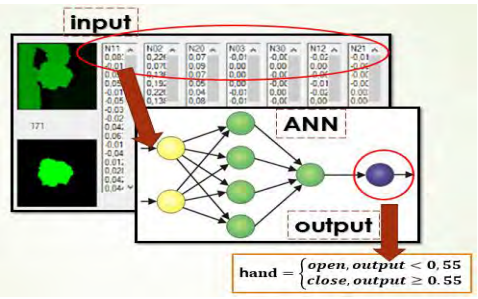

Figure 3. ANN for human hand recognition.

RESULT AND DISCUSSION

For the hand recognition testing, the output of ANN is stored in PC every 50ms for 6.25 seconds. As the result of closed hand condition test, 96 values of 125 data are accurately above the limit value (5.5). So the percentage of successful hand recognition system is 76.8%. Figure 4 is the ANN data output of the first test.

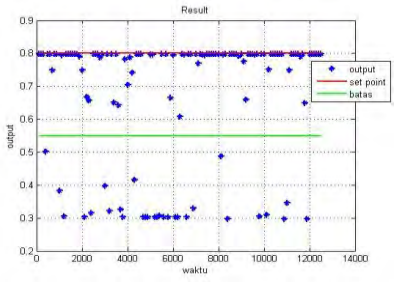

Figure 4. ANN output for first test.

The second test is performed on the condition of the moving arm. In opened hand condition, 91 values of the 125 result data are below the limit value (5.5). Hence, the percentage of the hand recognition system accuracy is 72.8%. The ANN data output for the second test is shown by Figure 5.

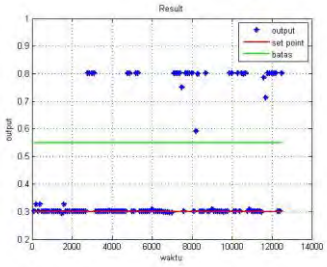

Figure 5. ANN output for SECOND test.

CONCLUSION

In this study, a BPANN method is used for human hand recognition based on depth image of Kinect camera. The accuracy rate of the hand recognition is more than 70%. For practical implementation, the ANN output can be used to control the robot hand for grasping an object.

ACKNOWLEDGEMENTS

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REFERENCES

[1] Ren, Zhou, et all., "Robust Part-Based Hand Gesture Recognition Using Kinect Sensor", *IEEE Transactions on Multimedia*, Vol. 15, No. 5, pg. 1110-1120, 2013.

[2] Tashev, Ivan, "Kinect Development Kit: A Toolkit for Gesture-and Speech-Based Human-Machine Interaction", *IEEE Signal Processing Magazine*, 2013, pg. 129-131.

[3] Megalingam, R.K., et all., "Kinect Based Gesture Controlled Robotic Arm: A research work at HuT Labs", *IEEE International Conference in MOOC, Innovation and Technology in Education* (MITE), pg. 294-299.

[4] Kofman, Jonathan, Wu, Xianghai, Luu, T.J., and Verma, Siddharth, "Teleoperation of a Robot Manipulator using a Vision-Based Human-Robot Interface", IEEE Transactions on Industrial Electronics, Vol. 52, No. 5, pg. 1206-1219,2005.

[5] Kadir, Abdul, *Dasar Pengolahan Citra dengan Delphi*, Yogyakarta: Penerbit Andi, 2013.

[6] Purnomo, Hery Mauridhi and Kurniawan, Agus, *Supervised Neural Networks dan Aplikasinya*, Yogyakarta: Graha Ilmu, 2006.

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Self Tuning Sliding Mode Control for Quadrotor Waypoint Tracking

Swadexi Istiqphara[1], Trihastuti Agustinah[1], and Ali Fatoni[1]

Abstract–In this paper, self-tuning sliding mode control is proposed to control quadrotor with mass parameter uncertainty on waypoint trajectory tracking. Parameter uncertainty is one of the factor that cause instability of quadrotor. Self-tuning sliding mode control is used to maintain the stability of quadrotor in this parametric uncertainties condition. The simulation results show that the quadrotor can track the waypoint trajectory in the presence of parameter uncertainty.

Index Terms - quadrotor, UAV, waypoint tracking control, Sliding mode control.

INTRODUCTION

Currently, unmanned aerial vehicle (UAV) has been widely used for various purposes such as search and rescue mission, mapping and surveillance. Generally, UAV can be divided in two categories, fixed wing and rotary wing. Quadrotor is one type of UAV rotary-wing that fly by using four propellers. The difference between quadrotor and fixed-wing vehicle is that quadrotor can take off and land vertically (VTOL) in small spaces, and hover and fly with high maneuverability.

There are various control methods used to solve stabilization and tracking problem of quadrotor, such as sliding mode control, optimal PID, nonlinear backstepping, etc. Sliding mode control has been proposed in [1] to track waypoint trajectory. The control system can track the trajectory fast. However, the actual position is displaced from the trajectory in the presence of disturbance on x-y translation. The developments of a PID control method to obtain stability in flying the Quad-rotor flying object is explained in [2]. LQ and PID controller are compared to control the attitude of quadrotor [3]. The simulation results show that both control methods provide average results, due to modelling imperfections. Nonlinear backstepping control is used to track a waypoint trajectory of quadrotor [4]. The simulation results show that the proposed control system provides good performance.

In this paper, self-tuning sliding mode control is used to track waypoint trajectory with mass parameter uncertainty of quadrotor. Quadrotor is simulated to track to desired waypoint, then landing to take the object with unknown mass and drop the object to another waypoint. Parameter gain K of sliding mode control is tuned based on least square method to handle the unknown added mass, and the conventional sliding mode control is used to control rotation motion (see Figure 1).

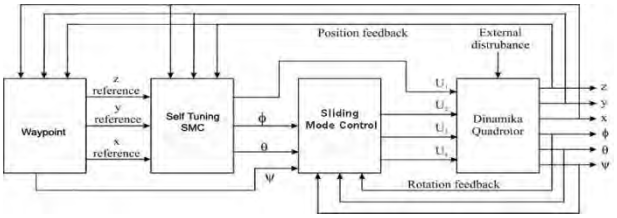

Figure 1. Control System Diagram block.

RESULTS

To measure the effectiveness of proposed method, the simulation is done by using Matlab/Simulink. Object is taken at waypoint #2 to simulate the parametric uncertainty of quadrotor. Quadrotor must track the waypoint trajectories that listed on Table 1.

TABLE 1. WAYPOINT COORDINAT

Waypoint	*X*	*Y*	*Z*	Mission
#1	0	0	10	0
#2	10	10	10	0
	10	10	0.5	Take Object
	10	10	10	0
#3	10	-10	10	0
#4	0	-10	10	0
	0	-10	0.5	Drop Object
	0	-10	10	0
#5	0	0	10	0

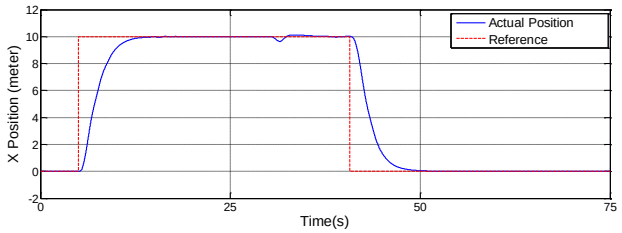

Figure 2. X-axis Translational Motion.

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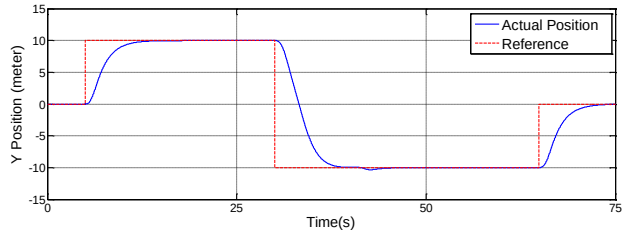

Figure 3. Y-axis Translational Motion.

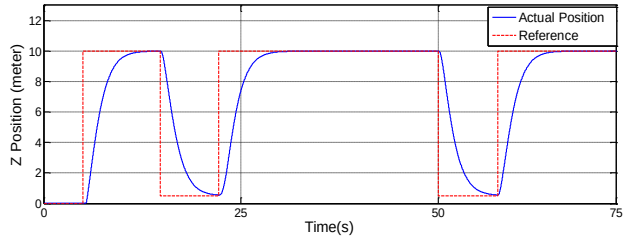

Figure 4. Z-axis Translational Motion.

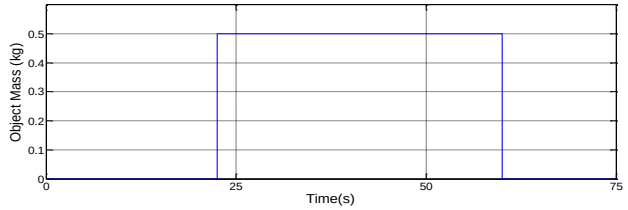

Figure 5. The Mass Parameter Changes Scenario.

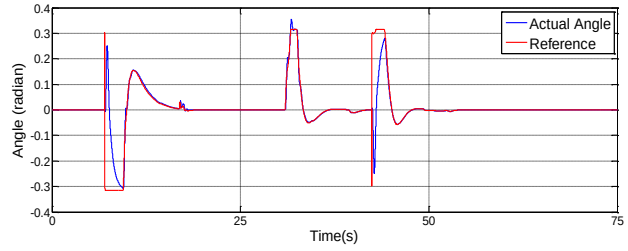

Figure 6. Pitch Angle.

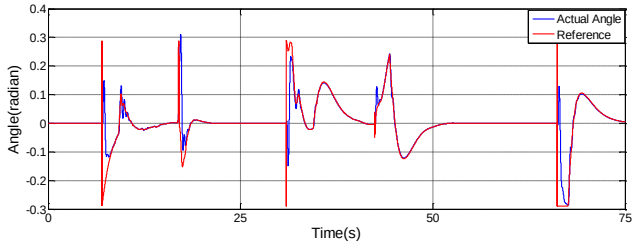

Figure 7. Roll Angle.

Figures 2-4 show the translational motion of X, Y and Z axis. From these figures, it can be seen that quadrotor performance did not affected by the mass parameter changes. The parameter change scenario is as shown in Figure 5. The output of self-tuning sliding mode controller (i.e. pitch angle and roll angle) is as shown on Figure 6-7. It can be seen that the angles change when quadrotor track from one waypoint to the next waypoint. These angles do not change when parameter changes occur. Figure 8 shows the vertical motion (Z axis) of quadrotor.

The gain changes that occur in simulation is as shown in Figure 9. From this figure, it can be seen that the controller must raise the control signals to handle the additional mass and lower the control signals in case of the mass of the object reduced.

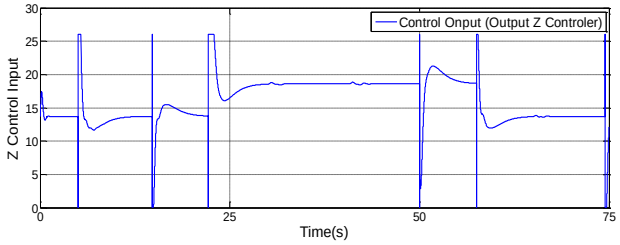

Figure 8. Z-axis control input.

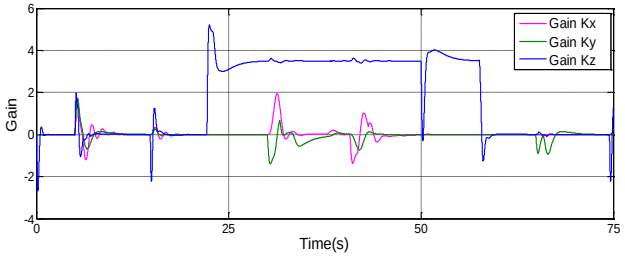

Figure 9. Gain Changes that Occur in The Simulation.

CONCLUSION

In this paper, self-tuning sliding control strategy is presented. The simulation results show that the proposed control system is able to stabilize the quadrotor and track the given waypoint trajectory. There is no chattering phenomenon on the control input of the system. The control system still give good performance in the presence of the parameter change.

REFERENCES

[1] V. G. Adir,A.M Stoica, J. F. Whidborne. "Sliding Mode Control of 4Y Quadrotor". U.P.B Sci. Bull.2012.

[2] A. L. Salih, M. Moghavvemi, H.A.F. Mohamed, and K. S. Gaeid, "Modelling and PID Controller Design for a Quadrotor Unmanned Air Vehicle" *Scientific Research and Essays*, vol. 5, pp. 3360–3367, 2010.

[3] S. Bouabdallah, N. Andre, R. Siegwart, "PID Vs LQ Control Techniques Applied to An Indoor Micro quadrotor". Proceedings. 2004 IEEE/RSJ International Conference on. Sept, 2004.

[4] T, Madani., Benallegue, A. "Backstepping Control for Quadrotor Helicopter". Proceedings. 2006 IEEE/RSJ International Conference on Inteligent Robots and Systems.Beijing,China. Oct, 2006.

Analysis of N-nitrosodiprophylamines Carcinogenic Compound in Meat-Processing using Headspace-Single Drop Microextraction-Gas Chromatography-Flame Ionization Detector (HS-SDME-GC-FID)

Teguh Hari Sucipto[1], Ganden Supriyanto[2], and Yanuardi Raharjo[2]

Abstract - Analysis of N-nitrosodiprophylamines carcinogenic compound in processed meat especially hamburger and kebab had occured by HS-SDME-GC-FID technique. The results were obtained determining the optimum pH was 4, the optimum stirring speed was 6 scale, and the temperature of extraction was 30 ºC. It was obtained in this study that the detection limit of 78 ppb, the percent recovery of 101,18%, precision between 0,089% to 0,566%, and the true enrichment factor was 3372,66 times. From the results of the study was concluded that HS-SDME-GC-FID technique can be used to analyze the carcinogenic compound N-nitrosodiprophylamines (NDPA) found in meat-processing (hamburger and kebab) by the concentration of each samples as follows, hamburger I of 0,27 ppm, hamburger II of 0,73 ppm, hamburger III of 1,39 ppm, and kebab I of 3,13 ppm.

Index Terms - HS-SDME-GC-FID technique, N-nitrosodiprophylamines, Meat-processing

INTRODUCTION

The cause of cancer was caused by nitrosamine compound that attacks on certain organs, such as stomach [1]. The results of the various species of animals declared that nitrosamines were carcinogenic. In addition, nitrosamines were also toxic and mutagenic [2]. The level of tolerance N-nitrosamines in the human body ranges from 5 to 10 mg/kg of weight human body [3].

Based on the description above, considered the N-nitrosamines in this case NDPA was carcinogens in the human body and cause cancer, the need for an analytical technique that was simple and has a high sensitivity properties to detect the presence of N-nitrosodiprophylamines (NDPA) in the food. Based on the properties of N-nitrosamines volatile (volatile), the HS-SDME extraction techniques (Headspace-Single Drop microextraction) very efficiently can be used. HS-SDME extraction technique has several advantages, namely avoiding the extraction with organic solvents when the contaminant in samples that may interfere with the analysis. In addition, HS-SDME extraction technique was also simple, easy, and does not require a long time of extraction. The existence of N-nitrosamine compounds can be identified using the instrument GC (Gas Chromatography). Gas chromatography (GC) was an analytical technique that can be used to identify chemical compounds with properties easily evaporated [4] and can detect samples up to µg/L.

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METHODS

In this study used to extract compounds toluene nitrosodipropilamin (NDPA). A total of 10 ml of standard solution (for example, a standard solution of 6 ppm NDPA) was inserted into the bottle containing a magnetic stirring bar. Microsyringe already contain organic solvents (eg, toluene as much as 3 mL) was inserted into the bottle vertically up hanging over the standard solution. Then the microsyringe tip was pressed so that the organic solvent hangs at the end of the needle. Then NDPA standard solution was stirred using a magnetic stirrer. After the extraction process was completed, the organic solvent was pulled back into a microsyringe and injected directly into the GC-FID instruments, and the resulting area for the standard concentration.

VALIDATION OF ANALYTICAL METHODS

The calculation of the limit of detection (LOD) NDPA, earned value detection limit of 78 ppb. This value was the smallest concentration limits can still be responded by Gas Chromatography. While the limit of detection for the calibration curve obtained without the extraction of 0.86 ppm. By comparing the value of the detection limit without extraction

of NDPA measurement and limit detection NDPA measur ements with HS-SDME extraction showed that the HS-SDME extraction method capable of increasing the sensitivity of GC-FID to provide a response to NDPA. It can be concluded that with the extraction method using the HS-SDME sensitivity GC-FID being very high [5].

Calculation% recovery between 99.87% and 105.65%, of the value can be inferred that the extraction method in determining the HS-SDME NDPA has good accuracy, or it can be said that this extraction method is actually closer proximity NDPA concentration. No recove ry value that indicates 105.65% due to other compounds that give the same signal at the retention time NDPA.

Method can be said to have the accuracy or precision was good if the value of the coefficient of variation (CV <3%) [6]. It can be concluded that the accuracy or precision produced by GC-FID used for the analysis of NDPA compounds in the sample, as evidenced by the resulting coefficient of variation of 0.089% to 0.566%.

Theoretical enrichmen factor (EF_{th}) was amounted to 3333.33 times. According to the theoretical concentration that occurs in the extraction process using the HS-SDME NDPA at 3333.33 times. While the actual or true concentration enrichment factor (EF_{tr}) amounted to 3372.52 times. So it can be concluded that the concentration process that occurs in the extraction using the HS-SDME good, because the results have EF_{th} not so much difference with EF_{tr}.

CALIBRATION CURVE OF NDPA

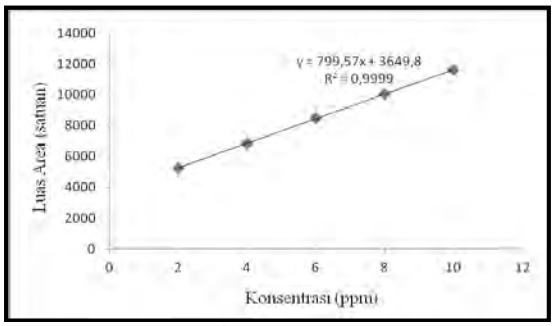

Figure 1. Calibration curve of ndpa with hs-sdme.

Calibration curve of NDPA with HS-SDME the analytic parameters optimum conditions. Calib ration curve of NDPA with the extraction of HS-SDME was obtained by linear regression y = 799.57x + 3649.8 with correlation coefficients (R2) of 0.9999. It shows there was a correlation between the concentrations of NDPA an area of the chromatogram.

SAMPLES ANALYSIS

TABLE 1. DATA OF NDPA CONCENTRATION IN THE SAMPLES.

	Concentration (ppm)
Samples	A
Hamburger	0,27
Kebab	3,13

CONCLUSION

Methods of HS-SDME-GC-FID can be used to analyze compounds N-nitrosodiprophylamines (NDPA) was contained in processed meats (hamburger and kebab). This method has a detection limit of the HS-SDME-GC-FID method was 78 ppb, the percent recovery of 101.18%, the precision between 0.089% to 0.566%, the theoretical enrichment factor of 3333.33 times, and a true enrichment factor 3372.66 times.

REFERENCES

[1] Domanska-Blicharz, K., Rachubik J., Kowalski, B., 2005, Occurrence of Volatile N-Nitrosamines in Polish Tinned Foods, *Bull Vet Inst Pulawy*, 49, 319-322.

[2] Andrade, R., Reyes, F.G.R., Rath S., 2005, A Method For The Determination of Volatile N-Nitrosamine in Food by HS-SPME-GC-TEA, *J. Food Chem.*, 91: 173-179.

[3] Filho, P.J.S., Rios, A., Valcárcel, M., Zanin, K.D., Caramão, E.B., 2003, Development of a New Method for The Determination of Nitrosamines by Miceller Electrokinetic Capillary Chromatography, *Water Research*, 37: 3837-3842.

[4] Riccio, D., Wood, D.C., Miller, J.M., 2008, Using Single Drop Microextraction for Headspace Analysis with Gas Chromatography, *J. of Chem. Education*, 85(7), 965-968.

[5] Sleiman, M., Maddalena, R.L., Gundel, L.A., dan Destaillats, H., 2009, Rapid and Sensitive Gas Chromatography-Ion-Trap Tandem Mass Spectrometry Method for The Determination of Tobacco-Specific N-Nitrosamines in Secondhand Smoke, *J. of Chrom. A*, 1216, 7899-7905.

[6] Miller, J.C., dan Miller, J.N., 1988, *Statistics for Analytical Chemistry Second Edition*, Elllis Horwood Limited, England.

An Analysis of E-Commerce Adoption for Small and Medium Enterprises in Indonesia

Fauzan Fahruzzaman[1] and Apol Pribadi Subriadi[1]

Abstract–The amount of small and medium enterprises (SME) is the largest number of business actor in Indonesia. But the contribution of SME is very small compared with large business. Some researchers found that the most influencing factor cause the condition is the use of information technology. May of the SMEs have not seen the power of information technology such as e-commerce. Author uses the qualitative method to gather deep information from informant that unfound in the recent quantitative research. This research will conduct how to implement the e-commerce based on some successful experiences in SME.

Index Terms – e-commerce adoption, SME performance, e-commerce success factor.

INTRODUCTION

In 2014, Indonesian SMEs were no fewer than 43 million people, or approximately 99% of the total businesses based on data from the Ministry of Cooperatives and Small and Medium Enterprises. The amount of labor involved in small businesses, according to the report, there were nearly 80 million people, or approximately 90% of the total labor force working in the industrial sector.

However, the contribution of small businesses to GDP becomes very small when compared to medium and large businesses. Related to the description above, the government reported that one of the major weaknesses of small businesses in Indonesia, as reflected in its economic contribution is the limited ability and aggressiveness of small businesses in accessing markets and the limited use of ICT in promoting their business. This research use the performance to measure the SMEs improvement. The performance measurement is considered by market share improvement and operational cost reduction. By that condition, e-commerce is the solution to increase the market share, so the SMEs could get more sales.

LITERATURE REVIEW

E-commerce is the basis of m-commerce by Turban (2001) identified consists of the Business To Business (B2B) and Business to Customer (B2C). A B2B ecommerce applications across the business, while the B2C e-commerce between businesses / companies and consumers. B2C services themselves vary from e-malls or cybermall, online advertising, electronic catalogs, online payment, customer service, service industries online. For businesses, the use of e-commerce is an opportunity to reach a wide market globally even with a marketing strategy that one-to-one marketing. It is of course offset by the huge benefits that can be obtained with the use of e-commerce for businesses. E-commerce can also be defined as the process of buying and selling of products, services and information are done electronically by using computer networks, namely one using the Internet.

Molla & Heeks (2007) identified four potential of e-commerce at the country level, namely: improving market efficiency, increase operational efficiency, expand access to markets, and an association (linkage). Market efficiency caused by the loss of one or more intermediaries that exist within a supply chain. Operational efficiency occurs through loss of inefficient business processes. Access the market with the opening of a wider network for doing business, and Linkage, through e-commerce capabilities to connect and integrate into global supply chains (Dolan & Humphrey, 2001; Gereffi, 2001) in Molla & Heeks (2007).

Another research [8] also proved that information technology does not have any positive correlation with company performance. Information technology only add operational cost in small and medium enterprise. This research use four main focus domain. They are the resource of e-commerce, e-commerce implementation, training and SME performance improvement. Based on those focus author try to explore the success factor in ecommerce implementation.

METHODOLOGY

In this research we use qualitative approach to gather information and explore the habitual of SME. By using that information author try to conclude the success factors in every e-commerce implementation.

I. Materials and Informant

The authors collected raw data from eight informant who success implementing e-commerce in SME. All of informants were chosen by purposive method. Authors does not take a risk by using random sampling in qualitative research.

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II. Procedure

First, author make a discussion to decide informant by asking to expert that have some knowledge about the SME condition in Indonesia. Then author try to give an interview with the selected informant and record the conversation in the voice recoreder.

III. Research Question

In this research, we are interested in understanding how SME can improve their performance by implementing e-commerce. Therefore, this study address the following research questions:

(1) What are the success factors for implementing e-commerce in SME? (2) Does the e-commerce implementation improve the SME's business performance?

ANALYSES AND RESULTS

In qualitative research the first analysis phase is coding. There are 10 factors that found after classify the coding result and making theme in every classification. The 10 factors is derived from the conceptual model in literature review. They are type of e-commerce, size of SME, type of user training, infrastructure condition, and SME compability with e-commerce, SME point of view, competitor, self-efficacy, e-commerce anxiety, and government support.

In another hand, author also found some factors that also influence the success of e-commerce implementation in SME. They are: the respond time, content management, the IT consultant role, user understanding about e-commerce, SME condition before implementing e-commerce, social media activity and the user interface of the e-commerce website.

Authors use triangulation and member checking method to validate and verify the result. riangulation means using more than one method to collect data on the same topic. This is a way of assuring the validity of research through the use of a variety of methods to collect data on the same topic, which involves different types of samples as well as methods of data collection.

CONCLUSION

SME has bright future when they can take an advantage of information technology. Beside cost reducing, they can reach wider market share. E-commerce is one of the solution to promote SME products. If new SME want to implement e-commerce and want to be success, they have to consider those factors. It was not enough to implement ecommerce without consider the success factor.

REFERENCES

[1] Alam, S. S. (2009). ICT adoption in small and medium enterprises: an empirical evidence of service sectors in Malaysia. International Journal of Business and Management, 4(2), 112-125. .

[2] Al-Gahtani, S. S. (2007). Information technology (IT) in Saudi Arabia: Culture and the acceptance and use of IT. Information and Management, 44(8), 681-691.

[3] Creswell, J. (2010). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 3th Edition.

[4] Subriadi, A., Hadiwidjojo, D., Djumahir, Rahayu, M., & Sarno, R. (2013). "Firm Age, Firm Size and Information Technology Intencity Industry Faktors in Influencing Information Technology Contribution to Improve Performance", Journal Of Thepretical and Applied Information Technology Vol. 54 No.3..

[5] E, D. W. (2003). "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update", Journal Of Management Information Systems 19(4), 9–30. .

[6] Erawan, M. (2014). Readiness of Indonesian Companies for ASEAN Economic Community (AEC) - Preliminary Findings from Automotive and Garment Industry (Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management).

[7] Ghobakhloo, M., Sabouri, M., T.S, H., & Zulkifli, N. (2011). "Information Technology Adoption in Small and Medium-sized Enterprises; An Appraisal of Two Decades Literature", Interdisciplinary Journal of Research in Business, Vol. 1, Issue. 7, July 2011(pp.53-80). .

[8] Prassida. (2015). The Contribution of Information Technology for SMEs Performance Improvement. Sisfo Journal, Vol 5, no 1.

Braille Character Recognition Using Artificial Neural Network

Joko Subur[1], Tri Arief Sardjono[1], and Ronny Mardiyanto[1]

Abstract*—Braille letter is characters designed for the blind, consist of six embossed points, arranged in a standard braille character. Braille letters is touched and read using fingers, therefore the sensitivity of the fingers is important. Those characters need to be memorized, so it is very difficult to be learned. The aim of this research is to create a braille characters recognition system and translate it to alpha-numeric text. Webcam camera is used to capture braille image from braille characters on the paper sheet. Cropping, grayscale, thresholding, erotion, and dilation techniques are used for image preprocessing. Then, artificial neural network method are used to recognize the braille characters. The system can recognize braille characters with 99% accuracy even when the braille image is tilted up to 1 degrees.

Index Terms*— Artificial neural network; Braille characters; Image processing; Webcam.

INTRODUCTION

Reading is one way to get information, but for those who are blind it will be difficult if to read the regular letters. Therefore, letters for the blind people was specially designed, named braille letters. Braille letters is consist of six points, which is three lines with two points. Six points can be arranged in such a way to create a variety of combinations. Usually, braille letters is read by touching the dot on the braille paper using fingers.

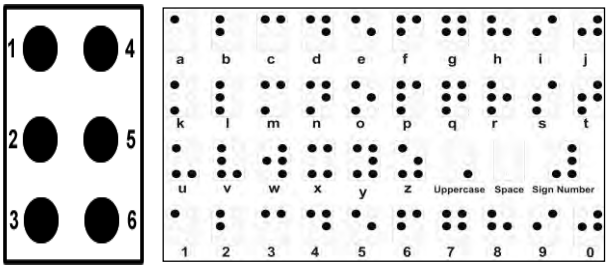

Figure 1. Dot braille character structure.

To be able to read braille by feeling, a person needs to learn it. This is usually takes a long time, because the sensitivity of the hands should be trained. Besides that, the dots and the combinations that form a letter should be understood and memorized. Therefore, there are not many person able to read braille. It is necessary to research assistive technology to translate braille into text to make it easier to read. Therefore, it will take a relatively shorter time compared to read it using finger.

In the previous research, a scanner is used to take pictures of braille, then image processing is done and output is generated in text. The scanner is also used as a tool to get braille pictures, as well as applying the method of neural network in the recognition process of braille. From the results of previous research, it is known that most systems used a scanner to get braille pictures and the system is made to work offline. Therefore, this research aimed to make a real time braille recognition system. The system can be real time because a webcam is used to get braille pictures and webcam is connected to a computer system. From pictures obtained braille, then do image processing and artificial neural network method is used to recognize the letters. With so may make it easier for users to do the reading braille, without having to process through the scanner first.

METHOD

The steps for braille letters recognition used in this research is shown in Fig. 2, such as:

- Capturing braille letters image using webcam,
- Image preprocessing
- Find coordinates x and y each dot braille
- Segmentation area braille characters
- Recognize braille characters

A. Capturing Braille Image

To take braille images, braille paper is captured using a web camera with a resolution of 640 pixels x 480 pixels. The distance between the webcam and braille paper is ±15cm. Results from the capture process is generated as image files of *.jpeg type and has an RGB color scale.

B. Image Processing

This process is used to prepare the picture for the next process, to make it easier in the process of braille letters recognition. In this process including: crop image, grayscale, thresholding, erotion and dilation.

C. Find Coordinates Each Dot Braille

Coordinate each dot of braille character can be detected using find contour technique. In this process will be result coordinates data of dot braille in rows and columns. After coordinates each dot is know, then can be next process is segmentation area a braille character.

D. Segmentation Area Braille Character

Recognition braille character can be better if determine of area segmentation braille character is correct, Segmentation is done by making a small segment as many as 40 areas of segmentation, which consists of 5 columns and 8 rows. The result segmentation area process shown in Fig. 3.

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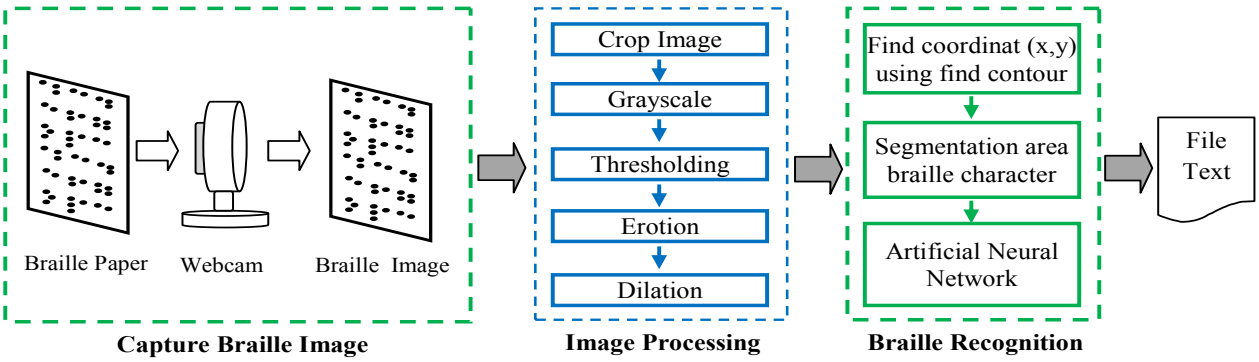

Figure 2. System block diagram of braille letters recognition using artificial neural network method.

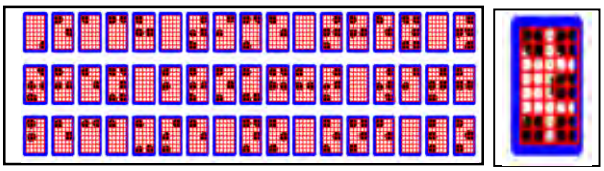

Figure 3. Segmentation small each braille character.

From 40 area small segmentation will be read value of pixels. Where in this area is value betwen 0 (black) or 255 (white), each small area segmentation will be get 1 data input. So, result in this process will be 40 get data. This data will be as data input for artificial neural network process.

E. Artificial Neural Network

Artificial Neural Network (ANN) is a mathematical model in the form of a collection of units connected in parallel which resembles a neural network in the human brain. So can be used then ANN must be learning first. Learning process by providing the data input of the data patterns is included with the desired target output value.

In this research made five kinds of data patterns at each of the braille characters. In the output layer 6 neuron used, because will purpose can be make combination binary 6 bit. Structure topology ANN can be shown in fig.4.

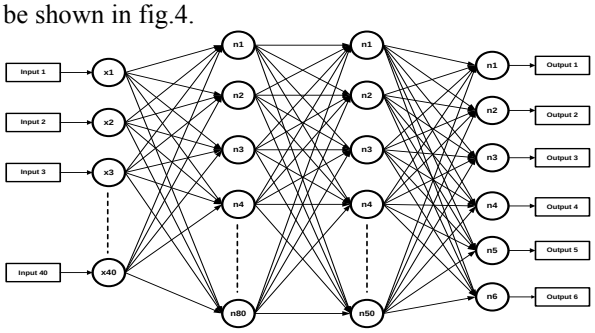

Figure 4. Structure topology of ANN in used.

RESULTS

To determine the level of accuracy of the system in recognizing braille character, it is tested by performing the introduction of braille on 10 different images data. The test is done with a variety of degree of picture tilting. The degree ranging from -1.5 degrees to 1.5 degrees.

TABLE 1. THE DATA OF EXPERIMENT BRAILLE RECOGNITION

Degree	All Data				
	Actual	**Read**	**Mising**	**Error**	**Accuracy**
0º	1229	1226	3	0,25 %	99,75 %
0,25º	1229	1225	4	0,33 %	99,67 %
0,5º	1229	1225	4	0,33 %	99,67 %
0,75º	1229	1214	15	1,23 %	98,77 %
1º	1229	1221	8	0,66 %	99,34 %
1,25º	1229	731	498	40,53 %	59,47 %
1,5	1229	24	1205	98,05 %	1,95 %

CONCLUSIONS

In this research, the braille recognition system using artificial neural network method is realized. From the experimental results, accuracy level of 99% can be achieved by this sytem on the tilted the image of -1 degrees to 1 degrees. The level of accuracy began to decrease when the image is tilted more than 1 degree , and the system is unable to recognize the image at all when the image is tilted at 1.5 degrees. According to this, the image should be straighten first to get a better result.

REFERENCES

[1] Jie Li and Xiaoguang Yan, "Optical Braille Character Recognition with Support-Vector Machine Classifier," International Conference on Computer Application and System Modeling (ICCASM), 2010.

[2] Namba and Zhang, "Cellular Neural Network for Associative Memory and Its Application to Braille Image Recognition," International Joint Conference on Neural Networks, BC, Canada, 2006.

[3] Shreekanth. T and Udayashankara. V, "A Review on Software Algorithms for Optical Recognition of Embossed Braille Characters," International Journal of Computer Applications (0975-8887), volume 81-No.3, 2013.

[4] OpenCV Reference Manual, v2.2, Desember 2010.

Implementation of Navigation Target Seeker Mobile Robot Based on Pattern Recognition with Fuzzy Kohonen Network (FKN) Methods

Aditya P. P. Prasetyo[1], Katjuk Astrowulan[1], and Ali Fatoni[1]

[1]***Abstract-Navigation is a technique for determining the position and direction of travel in the actual environment. This navigation system can be implemented on a mobile robot to accomplish a specific task, in this paper is used in order to navigate the robot can move toward a specific target while avoiding obstacles exist. One of the control techniques used in mobile robot navigation is based on pattern recognition techniques. With a pattern that has been previously implanted in the "brains" of the robot, the mobile robot can take action in accordance with the movement of the pattern. This paper used method of Fuzzy Kohonen Network (FKN) in order to be able to navigate a mobile robot to recognize patterns in the environment. The target used is a specific point designated position using a camera support (GPS Ad-hoc). Based on test results using this method, the obtained results are satisfactory, precisely to the targets and fast search time targets.***

Index Terms – Navigation of Seeker Target, Pattern Recognition, Fuzzy Kohonen Network, GPS Ad-hoc.

INTRODUCTION

Navigation on the mobile robot system has two main objectives, namely to avoid obstacles and steer the robot toward the target. To meet these two main objectives, then by using the method of FKN expected movement of the robot can take action in accordance with the pattern that has been implanted environment. In addition, with the help of the camera as GPS Ad-hoc [1], then the position of the robot and the target can be known.

DESIGN AND METHOD

In this section will discuss the design of target localization system architecture and control mechanism. It also describes the FKN method used for robot seeker target navigation.

I. Design of Target Localization System Architecture

Application of the target localization in the real world requires a definite architectural design to ease modularization. Modularization easier for researchers to try a new search algorithm without having to change much in the microcontroller on the robot. In this case the author designed the architecture of the localization of the source of gas by dividing into three major parts, namely: behavioral modules, camera modules and communication modules, as shown in Figure 1.

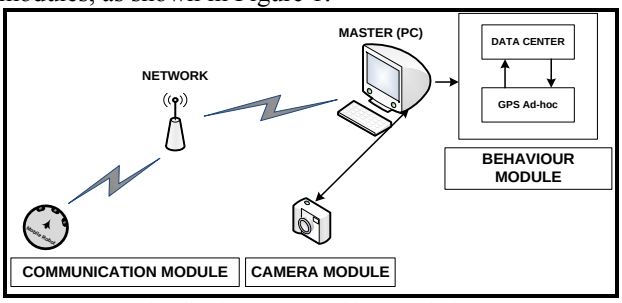

Figure 1. Target localization system architecture design.

II. Design of Control Mechanism

Control mechanism using the FKN broadly divided into two stages, namely the first stage by infrared sensor readings against obstruction and the environment, then through FKN as direct control method will move the robot to avoid obstacles and navigate to find targets. If the obstacle is not detected again, then in the second stage of this GPS Ad-hoc coordinate robot will move towards the target area detected with the help of a compass sensor to determine the degree of position. On this mechanism, DC motors act as actuators that control the movement of the robot toward a certain direction and position. In the Figure 2 shows mechanism controls used.

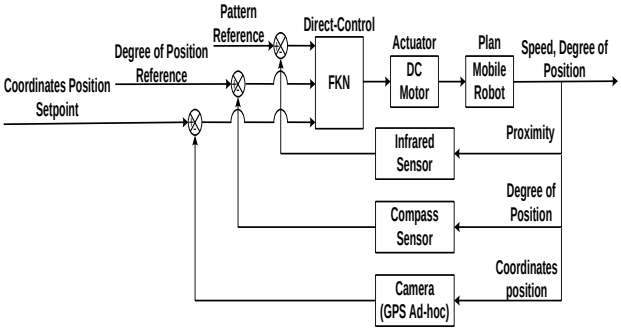

Figure 2. Control Mechanism.

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II. Fuzzy Kohonen Network

FKN is one type of Neuro-Fuzzy method which is the result of integration between fuzzy logic and neural network (Kohonen) [2].

FKN technique, the weighting is obtained from the prototype to the changing patterns of input patterns [3]. The pattern comes from experiments using some sample data and will ultimately obtained the corresponding weights. Each pattern prototype made interconnected with one rule in the rule table. The overall structure of FKN can be seen in Figure 3.

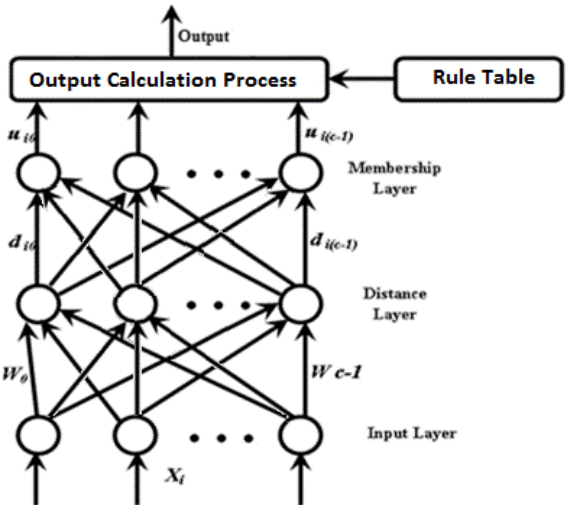

Figure 3. FKN Structure.

RESULT AND DISCUSSION

Once the program FKN has invested in mobile robot and visual program on the server computer that displays the robot movement data, curve DC motor, the trajectory and the camera has been made, then the Figure 4 is a view when the robot has successfully hit the target.

Tests performed 10 times by putting the robot at the starting point with the same pixel x = 38 and y = 25, whereas the target pixel point is the value of x = 240 and y = 100.

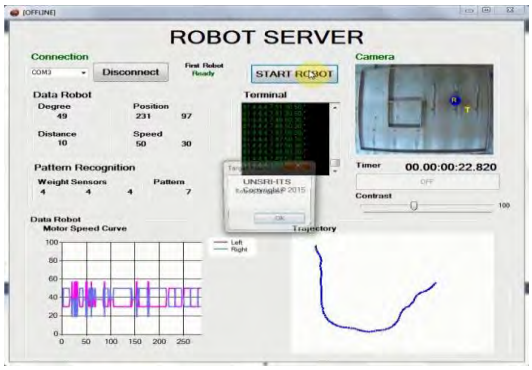

Figure 4. Robot Server Visual.

From these tests obtained average time search target of 23252 miliseconds and the average distance of the target was found in 8.92 pixel. Below is a table 1 which shows the results of the test.

TABLE 1. TABLES OF TEST RESULTS

Order Test	X Point (Pixel)	Y Point (Pixel)	Degree (°)	Distance (Pixel)	Time (ms)
1	228	102	53	8.54	23033
2	232	103	75	8.54	23469
3	232	99	50	8.06	23683
4	231	104	73	9.85	23694
5	232	104	63	8.94	23798
6	231	99	52	9.06	23680
7	232	98	49	8.25	23037
8	231	103	62	9.49	23251
9	232	96	59	8.94	22378
10	231	97	55	9.49	22492

CONCLUSION

Based on the test results are known FKN method has been successfully implemented as a navigation for target seeker mobile robot through pattern recognition. By using FKN method, the target can be found quickly and precisely.

REFERENCES

[1] Devarajan Dhanya et al. "Distributed Metric Calibration of Ad-Hoc Camera Networks", ACM Transactions on Sensor Networks, 2006.

[2] Song Kai-Tai dan Huang Shin-Yi, "Mobile Robot Navigation Using Sonar Direction Weights", IEEE International Conference on Control Applications, 2004.

[3] Siti Nurmaini et. al. "Intelligent Navigation in Unstructured Environment by using Memory-Based Reasoning in Embedded Mobile Robot", European Journal of Scientific Research, Vol.72 No.2 (2012), pp. 228-244, 2012.

Parsing Indonesian Syntactic with Recursive Neural Network

Karisma Trinanda Putra[1], Djoko Purwanto[1], and Ronny Mardiyanto[1]

Abstract-Sentence is a form of human communication which is closely related to language system. Sentence is one of the recursive structures that are often found in daily conversation. Learning syntactic structure is useful to explore the meaning of the sentence contained on it or translated it into another language such as machine language. The problem is meaning, ambiguity, and the language that is not according to the rules of syntax, causing the command translation become more complex. This research is about parsing Indonesian syntax based on natural language rules for applications in the field of human-machine interaction. Each word that is a part of the sentence, is mapped into vector-space model. To estimate the potential connection of two words, we use the recursive neural network. The potential connection of two words translated into a higher structure to obtain a complete sentence structure. We obtain 93% accuracy, with 50 data-set are given in the learning process to represent a hundred vocabularies.

Index Terms - Natural language processing, vector-space model, recursive neural network.

INTRODUCTION

Basically, communication is one of the important things needed by humans as social beings. Humans can share information with each other with communication. Language is one way to communicate between individuals in society. With language, someone can express what he was thinking to others.

Natural language processing (NLP) is one branch of AI which focuses on solving problems that arise in natural language processing. Natural language is the language generally used by humans to communicate with each other. At present, natural language began to be implemented on a computer so that the computer can understand commands given by user. The problems in NLP include meaning, ambiguity, and the language that is not according to the rules of syntax.

Vector-space model (VSM) is a set of modeling languages which include semantic and syntactical features in natural language processing. VSM has been shown to improve performance in NLP tasks such as syntactic parsing [1]. VSM based on neural network can outperform n-gram models in statistical modeling language standard [2]. Recursive structure is commonly found in natural language syntax rules. Recursive neural network (RNN) can predict the hierarchical tree structure [3] [4]. RNN has succeeded in representing the sentence based on the vector-space model [5].

The goal of this research is to study the natural language processing in Indonesian. Learning the language syntax tree structure will be beneficial to understand the meaning for more natural human-machine interaction.

PROPOSED METHOD

The parsing system consists of two processes, namely mapping into VSM and parsing words with RNN. Neural network (NN) is used to support the vocabulary mapping process. In the process of syntax parsing, the words will be transformed into a vector by matching them with a VSM database. RNN will calculate the value of the connection for each pair of words in a sentence.

A. Mapping Indonesian Word into Vector-space Models

VSM mapping based on class divisions words and phrases. Each word will be represented in the one-hot representation [x1, x2, ..., xR] as NN input. The more recognizable vocabulary would certainly increase the dimensional number of one-hot representation. NN output is a vector value of the distributed representation [y1, y2, ..., yS] with a predetermined number of dimensions.

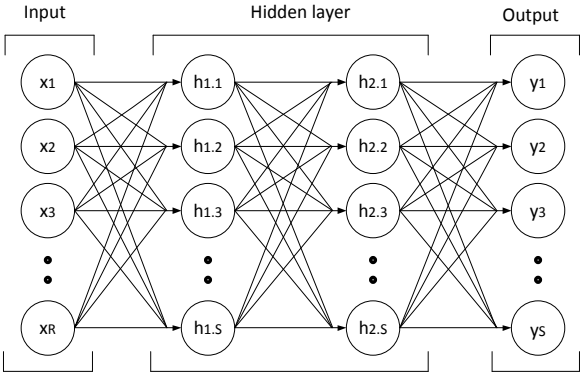

Figure 1. VSM-NN Topology.

B. Parsing Syntax with Recursive Neural Network

RNN has two outputs specially a potential value between words and phrases label. Potential value is the value that describes the strong-correlation between two words. Our RNN is a modification of the SU-RNN without using the different weighting values. In Figure 2, RNN output is

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syntactic features between two words. Output syntactic features include all phrases contained in Indonesian. Furthermore, the output value of the greatest of all connections word assessed by finding the highest value. Nodes that generate the highest value will unite generate vectors and label the new structure. The highest RNN output will be translated into a vector by using the VSM. This process is repeated to obtain the complete structure of the sentence.

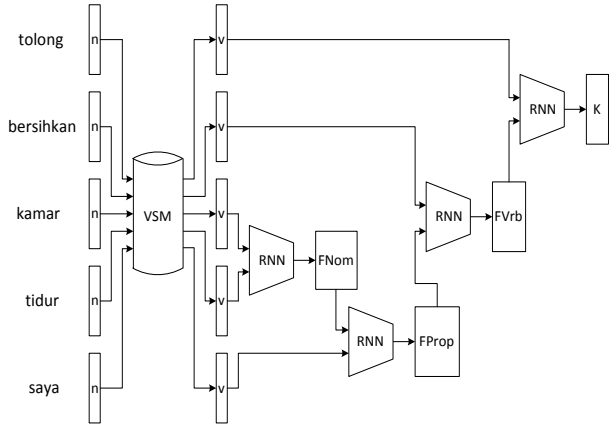

Figure 2. System design.

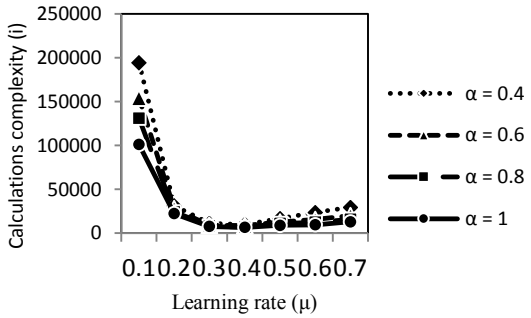

Figure 3. Variation of α vs μ and *i*.

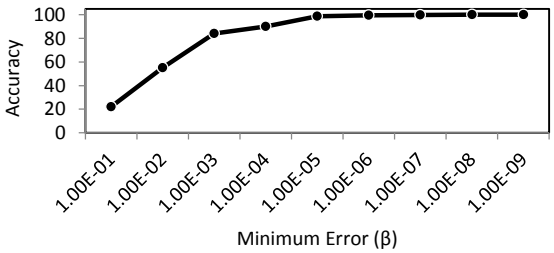

Figure 4. Testing Accuracy with 20-100 pairs of words.

EXPERIMENTS

A. VSM-NN Characteristic

The tests use variation of α, β, μ. We design NN which has 100 input neurons representing the word vector in one-hot representation, two hidden layers each consisting of 6 and 3 neurons and 3 output neurons representing the distributed representation in 3 dimension (6 → 6 → 3 → 3). Based on figure 3, the variation of α and μ will affect the complexity of the calculations. The more complex computer calculations cause the longer it takes to complete the process. For this reason, it takes an optimum value which produces the smallest computation complexity. The smallest value is obtained when using $\alpha = 1$ and $\mu = 0.4$.

B. Structure Parsing Accuracy

The tests use a 3-dimensional vector to represent 100 vocabulary in Indonesian. We design NN which has 6 input neurons representing the word vector sequence, two hidden layers each consisting of 6 neurons and 11 output representing the class of phrase (6 → 6 → 6 → 11). The learning process using 30, 40 and 50 combinations of common words and corresponding to Indonesian syntax. Testing is performed by giving 20 to 100 vector combination of two words following each other.

Accuracy will decrease with growing number of data learning. Decreased accuracy is also affected by the amount of data that is tested on RNN. To improve accuracy, we can multiply the learning data sets. The consequence is a growing number of learning data sets, the longer the process and there is a possibility that learning process does not reach the limit value of β. In figure 4, the average accuracy reaches 93%.

CONCLUSION

Indonesian natural language processing system can be performed by considering the semantic and syntactical rules. With 50 learning-set are given in the learning process to represent 100 vocabulary, we obtain about 93% accuracy. Accuracy decreases with increasing number of data tested. Accuracy can be improved by increasing the number of learning data sets but it sacrificed the learning time.

REFERENCES

[1] S. Richard, B. John, M. Christopher, N. Andrew, "Parsing with compositional vector grammars", Proceedings of the ACL conference. 2013.

[2] Yoshua, D. Réjean, V. Pascal, J. Christian, "A Neural Probabilistic Language Model" Journal of Machine Learning Research 3 1137–1155. 2003.

[3] S. Richard, C. Chiung-Yu Lin, Y. Andrew, M. Christopher, "Parsing Natural Scenes and Natural Language with Recursive Neural Networks", Proceedings of the 26th International Conference on Machine Learning (ICML). 2011.

[4] Ronan, W. Jason, B. L´ eon, K. Michael, K. Koray, K. Pavel "Natural Language Processing (Almost) from Scratch" Journal of Machine Learning Research 12. 2011.

[5] Danqi and M. Christopher "A Fast and Accurate Dependency Parser using Neural Networks" Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing (EMNLP). 2014.

The Design of E-Learning (share.its.ac.id) Course "Sistem Pengendalian Otomatis" to Support Effective Learning Outcomes

Syamsul Arifin[1], Aulia Siti Aisjah[1], Nurlita Gamayanti[2], Tutug Dhanardono[1],Yaumar[1], and Yusuf Bilfaqih[2]

Abstract - Open and integrated online learning is learning that promotes the use of learning content from colleges that have more resources for other universities in Indonesia. Subjects – "Sistem Pengendalian Otomatis" (SPO) 4 credits, one of subject in Engineering Physics Department, has been tested for blended learning with partner universities, between ITS with ITN Malang, ITT Bandung. Currently e-learning use by Sriwijaya University, UNSRAT-Menado and MUSAMUS-Merauke. Learning object designed in 8 Sub Achievement Learning - SCP, in cognitive, psychomotor and affective, in the activities: independent study, groups study in guided by lecturer, synchronous and asynchronous learning. Affective abilities measured by activity chats, forums, management capabilities to upload time of task, and the ability of communicate in writing. Psychomotor ability is measured by skill in the design of control in the mini plant or object and skill in programming. The skill have recorded by video camera and uploaded in the share.its.ac.id. Student followers of SPO course showed cognitive abilities, and 92% of them have met the achievement standards that have been set.

Index Terms- SPO, e-learning, share.its.ac.id, learning outcome.

INTRODUCTION

Prerequisite college curriculum is based on Permendikbud No. 73 of 2013 concerning KKNI (Indonesian National Qualifications Framework). Each study program required to prepare a description of the learning outcomes. Learning outcomes is an ability ac quired through the internalization of knowledge, attitudes, skills, competencies, and the accumulation of work experience [1]. Curriculum model implemented in Indonesia, following the Europe model, known as the curriculum to increase efficiency and effectiveness in college. 29 European countries have declared in June 1999 [2]. The curriculum is known as curriculum based Learning Outcomes.

Learning use a digital technology that is known m-learning will impact more efficient, effective, and intensive on learners (students). This media helps students to learn longer, deeper and more productive, if lecturers are able to provide learning content, technology, feedback, and generate self-management for learners [3]. The technology that supports the m-learning for interactive learning using a computer or other digital technologies, such as: IPAD, IPOD, Mobile phone, pocket PC, PDA [4], [5].

There are 12 characteristics of digital learning has been investigated by several previous researchers, that is; zero tolerance for delay, the computer is part of life, it is easy to access information, available tools, adept at multi-tasking, emphasizing the planning and management of time, globally connected, self-actualization, actively practicing, collaboration practicing in groups [6].

Learning Automatic Control Systems (ACS) courses TF091332 - 4 credits, has been done in blended learning, mobile learning on Face Book and share.its.ac.id since 2012 until currently. The module is placed on ITS server's. ACS was followed by students from the department of Engineering Physics ITS, and ITT Bandung; Electrical Engineering ITS and ITN Malang, Computer Systems UNSRI Palembang. Currently this course is run with students in Computer Systems UNSRI, Electrical Engineering UNSRAT and Electrical Engineering MUSAMUS.

METHODE

Description of Learning Outcomes expressed in the form of activities to be conducted, and the knowledge will be obtained by the students [7]. LO on each subject formulated compatible with the levels of Bloom's taxonomy in the cognitive domains (C), psychomotor (P) and affective (A) [2]. There are 8 topics corresponding to 8 LO, that is (1) Students

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are able to explain the function of Components in Automatic Control System (C2, A3), (2) Students are able to create a dynamic model system (C3, P3, A3), (3) Students are able to compare a Response of system dynamic models (C4, P3, A3), (4) Students are able to create a root locus charts (C4, P3, A3), (5) Students are able to compare a Frequency Response of system (C4, P3, A3), (6) Students are able to compare characteristics of P, I, D Controller and combinations of it (C4, P3, A3), (7) Students are able to distinguish a designing of P, I, D control systems and its combination, and Ziegler Nichols methods (C4, P3, A3), (8) Students are able to elaborate the characteristics Systems based on state space equation (C5, P3, A3). Notation C, P, A at each LO is the level of capability in the areas of Cognitive, Psychomotor and Affective. Identificati on capability at the final the course has been set as LO course, and have analyzed the suitability of LO with any Topic on subjects SPO [8].

Implementation of lectures conducted by ITS students, UNSRI, UNSRAT and MUSAMUS. Partici pants registered at ITS P3AI unit (Center for Development and Learning and Instructional Activities). This unit has the authority to control all activities of the students participating in m-learning. Table 1 shows the number of learning resources and activities are provided in the m-learning (share.its.ac.id). LO learning resources adapted to each subject. Activities designed to achieve LO, as well as the assessment conducted through assignments, quizz es online - multiple choice, exam - essay and activity in chats and forums.

RESULT AND ANALYSIS

The implementation of online courses SPO at 4 universities, i.e: ITS, UNSRI, UNSRAT and MUS AMUS, for synchronous and asynchronous activities are shown in Table 2. The percentage of students who upload tasks on the e-learning (share.its.ac.id) is very good, with an average of over 89%. This suggests that the role of the students is very high. Synchronous activity requires the initiation of the lecturer to give reward as an assessment of student activities. Asynchronous activity unsuccessful to invite all students to participate. This is indicated only 15% of the total number of active participants in the discussion. Learning resources can be used to achieve LO on any subject. The average value of an online quiz show abilities above 70% achievement of LO.

CONCLUSION

From the results and discussion that has been described in Chapter 3, it can be concluded that:

1. Activities students in e-learning on course SPO has been designed to support the achievement of LO
2. Learning resources provided had to support the achievement of LO
3. e-Learning (share.its.ac.id) can increase student competence in accordance with the achievements of the learning course
4. E-learning (share.its.ac.id) supports the achievement of LO

DAFTAR PUSTAKA

[1] Mendikbud, *Permen 073 Th. 2013, Menteri pendidikan dan kebudayaan republik indonesia*. 2013, pp. 1–9.

[2] D. Kennedy, Á. Hyland, and N. Ryan, "Writing and Using Learning Outcomes : a Practical Guide." Bologna, pp. 1–30, 2005.

[3] S. Higgins, Z. Xiao, and M. Katsipataki, "The Impact of Digital Technology on Learning : A Summary for the Education Endowment Foundation Full Report," Durham, 2012.

[4] M. Sharples, J. Taylor, and G. Vavoula, "A Theory of Learning for the Mobile Age," pp. 221–247, 2007.

[5] A. Litchfield, L. E. Dyson, and E. Lawrence, "Directions for m-learning research to enhance active learning," in *Proceedings ascilite Singapore*, 2007, pp. 587–596.

[6] S. S. Baharom, "Designing Mobile Learning Activities in The Malaysian HE Context: A Social Constructivist Approach," Salford, 2013.

[7] R. Phillips, C. Mcnaught, and G. Kennedy, "Towards a generalised conceptual framework for learning : the Learning Environment , Learning Processes and Learning Outcomes (LEPO) framework The Learning Environment , Learning Processes and Learning Outcomes (LEPO)," in *Proceedings of the 22nd annual world Conference on Educational Multimedia, Hypermedia & Telecommunications*, 2010, vol. 2010, pp. 2495–2504.

[8] S. Arifin, A. S. Aisjah, and Y. B. Faqih, "ICT-Based Learning ' AUTOMATIC CONTROL SYSTEM ' on share . its . ac . id as an Efficient Learning Center and Powered Impact Widely," in *ISODEL*, 2012, pp. 1–5.

TABLE 1. DESIGN ACTIVITY AND RESOURCES IN E-LEARNING (SHARE.ITS.AC.ID) THE COURSE OF SPO.

	2012	2013	2014
Number of modules (text)	16	54	54
Number of modules (video)	0	3	3
Number of modules (simulator)	0	0	3
Number of activity (forum)	4	8	9
Number of activity (chatting)	0	0	18
Number of activity (Upload Tasks)	4	9	10
Number of activity (Quiz online)	1	7	8
Number of activity (Survey)	0	2	2

TABLE 2. PERCENTAGE OF ACTIVITY STUDENTS IN SYNCHRONOUS AND ASYNCHRONOUS.

	2012	2013	2014
Percentage of active students in forum (asynchronous)	74%	95.12%	66.73%
Percentage of active students in forum (synchronous)	-	-	18.92%

TABLE 3. PERCENTAGE OF NUMBER STUDENT IN UPLOAD TASKS.

	2012	2013	2014
Percentage of student uploaded task	89.5	100	94.5

Design Fuzzy Disturbance Observer With Neuro-Fuzzy Invers Model For Parallel Hybrid Electric Vehicle Speed Controller

Yoga Alif Kurnia Utama[1], Trihastuti Agustinah[1], and Josaphat Pramudijanto[1]

Abstract–In this paper, fuzzy disturbance observer with neuro-fuzzy invers model is proposed to control speed of parallel hybrid electric vehicle (PHEV) with change in disturbance. Disturbance make unstable speed so that actual speed of PHEV is not equal to reference speed. Fuzzy disturbance observer is used to make actual speed of PHEV is equal to reference speed when disturbance applied on it. The result show that fuzzy disturbance observer can reject the disturbance so that so its speed has more stable .

Index Terms – Parallel Hybrid Electric Vehicle, Fuzzy Controller, Disturbance Observer, Neuro-Fuzzy Invers Model.

INTRODUCTION

In the last decade, there are a lot of transportation vehicles that use Internal Combustion Engine (ICE). Those have caused serious impact to natural environment that due to gas emissions pollutant which produces from them. One of many solutions is using Hybrid Electric Vehicle (HEV) as replacement of ICE system in the vehicles. Some researches of parallel HEV [2][3] in reference speed control show that actual speed is accurately same as speed in the same torque load. Most of that researches using fuzzy control for made it. But simulation show that when torque load was changed, actual speed is not accurately same as reference speed. That problem is will be solved in this paper.

This paper offers the usage of disturbance observer to overcome the disturbance such as torque load. Disturbance observer will be added to fuzzy controller so that actual speed is same as speed reference and it have resistance from disturbance. In this paper, that called fuzzy disturbance observer. The main component in designing the observer is the filter and model invers plant. Since the plant that used in this paper is parallel HEV, thus, it is difficult to find the parallel HEV's model invers. But in other research it was shown that neuro-fuzzy can described plant that has high nonlinierity [4]. Therefore, the neuro-fuzzy will be used in designing the model invers of parallel HEV. The neuro-fuzzy is able to describe the correlation between input and output accurately by execute training in the neuro-fuzzy network. Block diagram of fuzzy disturbance observer can be seen in Figure 1.

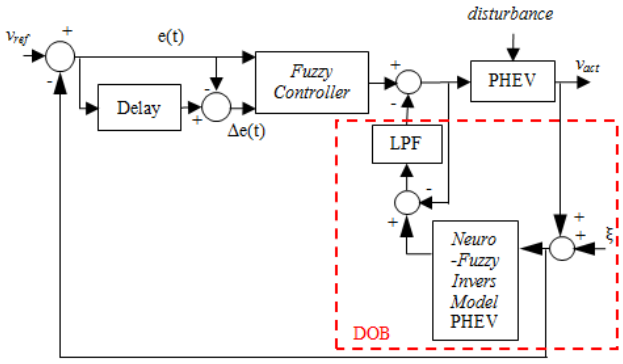
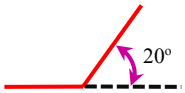
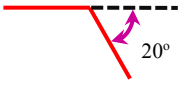
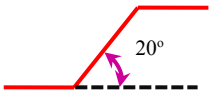
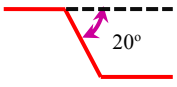
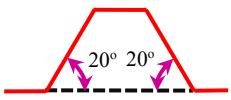
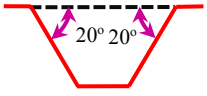


Figure 1. Fuzzy Disturbance Observer.

RESULTS

The simulation is run by using matlab simulink to obtain the characteristics of system responses. Controller will be tested by six disturbances that caused by six different road models. The road can be seen in Table 1.

TABLE 1. ROAD MODEL

No	Road Model	No	Road Model
1		4	
2		5	
3		6	

In this simulation, fuzzy disturbance observer will be compare with fuzzy controller in disturbance condition that can be seen in Figure 2. The result will be seen in Figure 3 until Figure 7.

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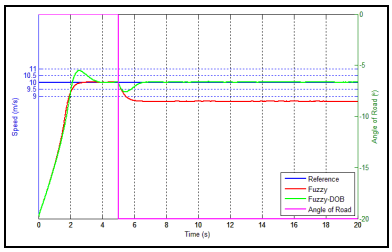

Figure 2. Respone with Disturbance I.

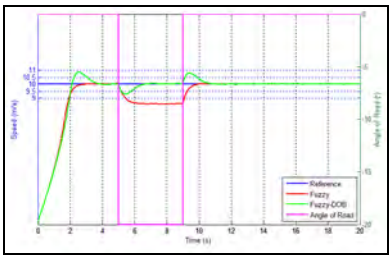

Figure 3. Respone with Disturbance II.

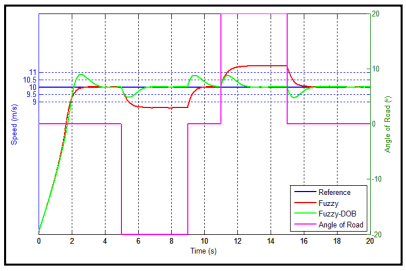

Figure 4. Respone with Disturbance III.

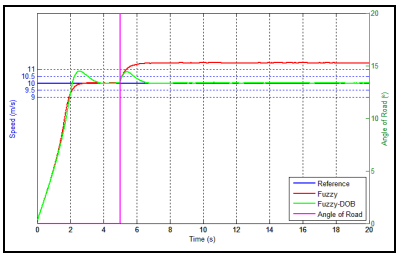

Figure 5. Respone with Disturbance IV.

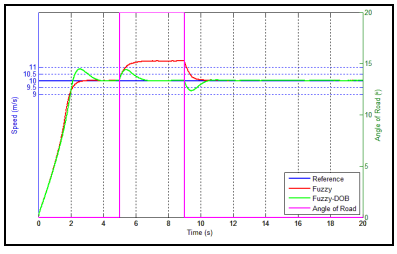

Figure 6. Respone with Disturbance V.

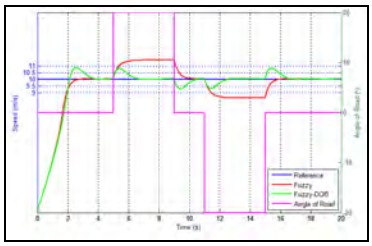

Figure 7. Respone with Disturbance VI.

The simulation results show that the fuzzy disturbance observer will make the actual speed equal to the reference speed that its value is 10 m/s. When the PHEV's climbing, so that the actual speed will decrease to 9.3 m/s and when the PHEV's coming down so that the actual speed will increase to 10.8 m/s. But although there is a difference between the actual speed and the reference speed, 1.75 seconds after disturbance that caused by angle of road, the actual speed will go to 10 m/s.

Different simulation results indicate that when the fuzzy controller used in the PHEV models. The fuzzy controller will make the actual speed will decrease to 8.6 m/s when the PHEV's climbing and increase to 11.4 m/s when the PHEV's coming down. The fuzzy controller will make the actual speed equal to the reference speed **only** when PHEV run on the flat road or there is no disturbance that was felt by PHEV. So when the PHEV have disturbance, so that the actual speed will not equal to the reference speed.

CONCLUSION

In this paper, two different controller was tested as a speed controller for PHEV. From the results, it's concluded is that fuzzy disturbance observer can be applied to parallel HEV where the controller can reject disturbance that caused by the road model with a certain slope. Fuzzy disturbance observer will make PHEV's speed more stable than fuzzy controller.

REFERENCES

[1] A.M. Harsha S. Abeykoon, Hasala R. Senevirathne, "Disturbance observer based current controller for a DC motor", Pages:47– 52, 2012.

[2] J.C. Gonzalez-Gomez, J.A. Ruz-Hernandez, R. Garcia-Hernandez, and E.N. Sanchez, "Real-time *neuro-fuzzy* inverse control applied to a DC motor", *2011 8th International Conference on*, Pages:1– 5, 2011.

[3] Mariam Khan and Narayan C.Kar, "Speed tracking performance of *fuzzy* based vector control of induction motor drives for hybrid electric vehicles", *Canadian Conference on*, Pages:000607– 000610, 5 May 2008.

[4] S. Wahsh, H. G. Hamed, M. N. F. Nashed, and T. Dakroy, "Fuzzy logic based control strategy for *parallel* hybrid electric vehicle", *Proceedings of 2008 IEEE International Conference on Mechatronics and Automation*, Pages:27 – 31, 20 May 2008.

The Fusion of Smartphone Sensors for Indoor 3D Position and Orientation Estimation

Hani Ramadhan[1], Charles Lenay[2], and Dominique Lenne[2]

Abstract-The improvement in smartphone technology has encouraged the exploration in field of user experience. The internal inertial navigation system sensors of a smartphone enables it to infer the its three dimensional indoor orientation and position when it is being pointed at certain objects by hand. However, the sensors' flawed measurements complicate estimation of position and orientation precisely. Previous studies shows that sensor fusion of both internal and external measurements can enhanced the performance. However, those estimations didn't cover the pointer-like usage. To achieve the possibility of smartphone as pointer, the estimation using sensor fusion has been performed. Unfortunately, these experiments resulted in bad position estimation for small precision, while the orientation estimation was passable.

Index Terms-Context-aware systems, Indoor localization, Wi-Fi fingerprinting, data fusion.

INTRODUCTION

During cultural or tourism visits, an informative guide of the interesting objects is necessary to enhance the knowledge and the experience of the visitors. This guide, in the meantime, can be provided by the smartphone because of its capability of being context-aware system. Mostly, the smartphone uses the context of position in two dimension (2D). However, smartphone can explore more possibilities in indoor positioning using its sensors.

The captured context of smartphone sensors are composed in 3 dimensions (3D) of both position and orientation (in X, Y, and Z axes). Those dimensions can be used to explore the feasibility of smartphone as guide which is held by hand to point at interesting objects, which can't be handled by 2D position only. Thus, the user experience can be enhanced.

Nonetheless, the sensors of the smartphone are not perfect to acquire good estimations of position and orientation. Position estimation used erroneous double integration of the accelerometer, which has terrible noisy measurement, while orientation estimation is affected by the gyroscope's drift and the easily disturbed magnetometer [1]. Thus, those sensors cannot be used independently to give adequate information to estimate position and orientation.

To overcome these drawbacks, previous researches had investigated fusion of the smartphone sensors internally [2] and its surroundings, including Wi-Fi signal strength [3, 4]. These methods of sensor fusion had provided fine estimation in indoor environment.

Still, the 3D position and orientation were separately studied, while the closest approach was the heading (Z-axis) and position estimation. The other orientation elements are important to determine the precision in pointing a direction of a hidden or interesting object.

Yet, the 3D position and orientation had been studied using robot camera [5]. But, the usage of camera in smartphone is not applicable in this study as the camera will block user's vision and drain the smartphone battery.

This study presents of the Wi-Fi fingerprinting [3] and the smartphone sensors real-time data fusion to estimate the 3D position and orientation of smartphone held by hand. To provide the data fusion, Kalman Filter [6] and Complementary Filter [2] are used. These algorithms are implemented inside the smartphone to guarantee its mobile characteristic. Then, the feasibility of using smartphone as pointer will be discussed in the later section.

PROPOSED METHOD

This study involves the estimation of 3D orientation and position estimation as depicted in **Figure 1**. The 3D orientation estimation approach sensor fusion uses complementary filter [2] towards gyroscope angular velocity and combination of magnetic field from magnetometer and gravity acceleration from accelerometer (digital compass) real-time data. Then, the 3D position is estimated using the result of Kalman Filter towards Wi-Fi fingerprinting [3] result and the linear acceleration which is derived from the smartphone API (Application Programming Interface).

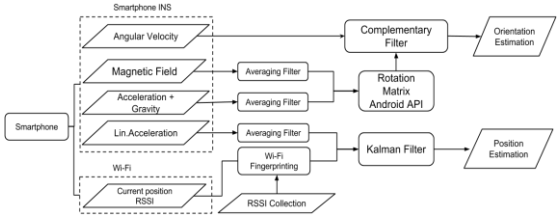

Figure 1. The proposed method flowchart.

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I. Complementary Filter

The complementary filter has an advantage to combine and smoothen the low-noise measurements by high pass filter, and high-noise measurements by the low pass filter [2]. This filter suits the characteristic of the gyroscope sensor for the high pass filter and the digital compass sensor for the low pass filter. Thus, these two measurements can be combined to have enhanced orientation estimation.

II. Wi-Fi fingerprinting

Wi-Fi fingerprinting by smartphone is based on two phases [3]. The offline phase acquires the radio signal strength indication (RSSI) from several reference points in desired environment and map them into the database of signal strength. Then, the online phase determines the position of user by comparing the current position RSSI with the RSSI map of signal strength from the offline phase. This position is obtained by weighted k-Nearest Neighbor [7], a deterministic positioning algorithm.

III. Kalman Filter

The Kalman Filter is widely used in data fusion because its popularity to minimize noises [4]. This filter recursively solves linear problem assuming the noise follows the Gaussian distribution using the previous time step state and the current measurement. The Kalman Filter is consisted of two stages: prediction (estimates the current state) and update (correcting the state using available observation).

In this case, the Kalman Filter's state are smartphone's position, velocity, and acceleration. Then, the available measurements for this filter are acceleration from linear acceleration and position from Wi-Fi fingerprinting.

RESULT AND DISCUSSION

The proposed method was tested using two scenarios of experiment. To test the quality of orientation estimation, a slow and a quick 90° rotation over all axis were performed. Then, position estimation quality was measured using 15 cm back-and-forth movement over all axis. The position estimation experiment was executed in two cases: within and without sensor fusion.

The orientation estimation has achieved a passable performance. This resulted in 32,406° standard deviation for Z-axis, 9,821° absolute error for X-axis, and 4,640° absolute error for Y-axis. Those errors were not mainly produced by the noisy sensors because some disturbance of hand from holding the smartphone might happen. The huge error in Z-axis case was also happened because of several electronic devices that might disturb the magnetometer.

However, the position orientation didn't work out by either fusion sensor or only accelerometer. Regardless of having 15 cm displacement each time, the estimation using accelerometer only gave accumulated error leading up to several meters displacement only in few seconds. In the other hand, Wi-Fi fingerprinting result and accelerometer fusion gave stagnant measurement of very far position (1 meter away) with small fluctuation around 2-3 cm.

Thus, by the incomplete position estimation result, the smartphone cannot serve pointer at all. However, it is possible to use another measurement to improve its quality.

CONCLUSION

According to the experimental result, the smartphone 3D position and orientation estimation using sensor fusion was not fully applicable. The estimation of position didn't work out well. However, the orientation estimation gave a promising result. In the future, the position estimation might be improved using another measurement, such as image processing by camera. Thus, the role of smartphone as pointer might be practicable afterwards.

REFERENCES

[1] U. Shala and A. Rodriguez, "Indoor Positioning System using Sensor-fusion in Android Devices," Kristianstad University, Kristianstad, 2011.

[2] S. Ayub, A. Bahraminisaa and H. Bahram, "A sensor fusion method for smart phone orientation estimation," in *Proceedings of the 13th Annual Post Graduate Symposium on the Convergence of Telecommunications, Networking, and Broadcasting*, Liverpool, 2012.

[3] O. Costilla-Reyes and K. Namuduri, "Dynamic Wi-Fi Fingerprinting Indoor Positioning System," in *2014 International Conference on Indoor Positioning and Indoor Navigation*, 2014.

[4] Z. Chen, H. Zou, H. Jiang, Q. Zhu, Y. C. Soh and L. Xie, "Fusion of WiFi, Smartphone Sensors and Landmarks Using the Kalman Filter for Indoor Localization," *Sensors,* vol. 15, no. 6, pp. 715-732, 2015.

[5] J. Wang and W. J. Wilson, "3D Relative Position And Orientation Estimation Using Kalman Filter For Robot Control," in *IEEE International Conference on Robotics and Automation*, Nice, 1992.

[6] G. Welch and G. Bishop, An Introduction to the Kalman Filter, Chapel Hill: ACM, Inc., 2001.

[7] B. Li, J. Salter, A. G. Dempster and C. Rizos, "indoor positioning techniques based on wireless LAN," in *LAN, First IEEE International Conference on Wireless Broadband and Ultra Wideband Communications*, 2007.

Automatic Detection of Proliferative Diabetic Retinopathy With Hybrid Feature Extraction Based on Scale Space Analysis and Tracking

Wilda Imama Sabilla[1], Rully Soelaiman[1], and Chastine Fatichah[1]

Abstract-Feature extraction is a process to obtain the characteristics or features of an object where the value of the features will be used for analysis in the next process. In retinal image, extraction of blood vessels' characteristics can be used for detection of proliferative diabetic retinopathy (PDR). Retinal blood vessels' features can be obtained directly with segmented image and with additional spatial method. For PDR detection, we need the suitable method that can produce maximum feature representation. This paper proposed hybrid feature extraction using a scale space analysis method and tracking with Bayesian probability. The result of the retinal images classification from STARE database using soft threshold m-Mediods classifier shows the best accuracy of 98.1%.

Index Terms - Feature extraction, soft threshold m-Mediods, proliferative diabetic retinopathy, retinal blood vessel segmentation, scale space analysis, tracking.

INTRODUCTION

Feature extraction is a process to get the characteristics of an object where the value of the features will be used for the analysis in the next process. In retinal image, extraction of blood vessels' characteristics can be used for detection of proliferative diabetic retinopathy (PDR). PDR is a disease affecting the eye that change the structure of blood vessels in the retina. Through feature extraction, retinal blood vessels can be differentiated into normal and abnormal which can be used for the detection of PDR.

Retinal vessels' features can be obtained using properties of a retinal image and segmented image, but it will be difficult for width and direction features. Hence spatial method is applied to obtain width and direction features. Scale space analysis method with isotropic undecimated wavelet transform (IUWT) is used to produce retinal image segmentation [1]. Width and direction features are obtained through the spatial domain using tracking methods [2]. After feature extraction, then performed classification to detect PDR. Retinal image data has multimodal distribution that requires special treatment in the classification. Soft threshold m-Mediods can perform classification in multimodal data which suitable to use in the retinal image classification [3].

There are other studies that did PDR detection but used different methods of feature extraction, such as with 2D Continuous Wavelet Transform [3], the combined standard line operator and the modified line operator [4], as well as Gabor wavelet and active contour method [5]. This study proposed a hybrid feature extraction based on scale space analysis and tracking with soft threshold m-Mediods classifier for the automatic detection of PDR.

PROPOSED METHOD

This section explains the method which is used in this study. Flowchart of system using the proposed method is shown in Figure 1.

I. Preprocessing

Image preprocessing is performed using thresholding to separate between retinal object and background into a binary image.

II. Isotropic undecimated wavelet transform

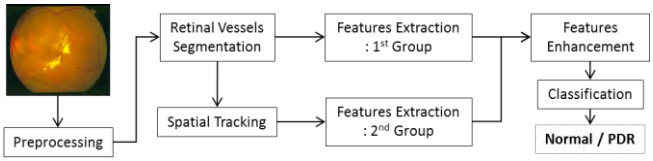

Figure 1. PDR Detection System's Flowchart.

Isotropic undecimated wavelet transform (IUWT) is a segmentation method using scale space analysis. In the two-dimensional or higher dimensions, filters, scaling function and wavelet function should be close to isotropic.

III. Spatial tracking with bayesian probability

Tracking starts with initialization to determine a pair of edge point of the blood vessel. At each iteration, tracking is performed with semi-ellipse dynamic window which is shown in Figure 2. Parameters such as vascular edge point, center point, direction and diameter of blood vessels are always stored. Iteration stopped when a blood vessel whose width is less than 1 pixel. At iteration k, a combination of two candidate points χ is selected from a set of candidate points Y_k of semi-ellipse window as the

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next edge points. Edge points selection is based on a combination of points that have the greatest Bayesian probability using Equation (1) where y_i is pixel intensity of a candidate point.

$$P(Y_k|\chi) = \prod_{i=1}^{N_k} P(y_i|\chi). \quad (1)$$

III. Feature extraction: 1st group

In the 1st group, features is obtained using properties of retinal and segmented image. The features are area, energy, mean gradient, standard deviation gradient, mean intensity, intensity variation, vessel segment, and vessel density.

IV. Feature extraction: 2nd group

To obtain vascular segment width and vascular direction variation, spatial tracking with Bayesian probability is performed on segmented image.

V. Multivariate m-Mediods classifier

Classifier method used is soft threshold m-Mediods. Before, local fisher discriminant analysis (LFDA) is applied to improve the representation of feature space. Learning vector quantization (LVQ) is used for modeling and recognition. Soft threshold m-mediods applied with more than one LVQ that can be referred as mediods. Class label is obtained using voting based on all LVQs output label. Several parameters is determined at this stage, such as the number of dimension reduction on LFDA, as well as number of hidden nodes and learning rate value on LVQ.

EXPERIMENTAL RESULTS

There are two type of evaluation in this study, evaluation for vascular segmentation with IUWT and for PDR detection with multivariate m-Mediods. For each evaluation, accuracy is determined using Equation (2),

$$accuracy = \frac{TP+TN}{TP+FP+FN+TN}, \quad (2)$$

where TP, TN, FP, and FN is obtained using Table 1.

TABLE 1. CONFUSSION MATRIX FOR ACCURACY

Actual	**Predicted**	
	Yes	No
Yes	TP	FN
No	FP	TN

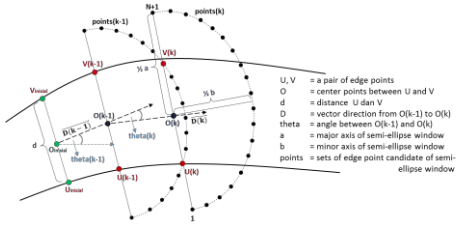

Figure 2. Semi-ellipse Window for Tracking.

I. Evaluation for vascular segmentation

Segmented image is evaluated against ground truth image. The results of the vascular segmentation evaluation with retinal image from DRIVE database generate the accuracy value of 95.04% with ground truth comparison.

II. Evaluation for PDR detection

Evaluation for PDR detection is performed with 24 train and 53 test data from STARE database to produce best accuracy. Based on our experiments, the optimum value of parameters such as number of dimension reduction on LFDA, number of hidden nodes and learning rate value on LVQ is 3, 8, and 0.1 respectively. Using the optimum value of these parameters, soft threshold m-Mediods classifier can produce the best accuracy of 98.1% for PDR detection. This result is better than study in [1] which has accuracy of 94.3% and [3] which has accuracy of 97%.

REFERENCES

[1] Wilda Imama Sabilla, Chastine Fatichah, Rully Soelaiman, "Implementasi Pengklasifikasi Segmen Vaskular Retina Mata dengan Metode M-Mediods Multivariat", *JURNAL TEKNIK POMITS* Vol. 2, No. 1, 2014.

[2] Yi Yin, Mouloud Adel, Salah Bourennane, "Retinal vessel segmentation using a probabilistic tracking method", *Pattern Recognition*, vol. 45, pp. 1235-1244, 2012.

[3] Shehzad Khalid, Anam Tariq, M. Younus Javed M. Usman Akram, "Detection of neovascularization in retinal images using multivariate m-Mediods based classifier," Journal Computerized Medical Imaging and Graphics, vol. 37, no. 5-6, pp. 346-357, September 2013.

[4] R.A. Welikala, J. Dehmeshki, A. Hoppe, V. Tah, S. Mann, T.H. Williamson, S.A. Barman, "Automated detection of proliferative diabetic retinopathy using a modified line operator and dual classification", Computer Methods and Programs in Biomedicine, vol. 114, pp. 247–261, May 2014.

[5] Israr Ul Haq, Usman Akram, Yoshifumi Saijo, "Automated Detection of New vessels for Classification of Proliferative Diabetic Retinopathy", *the 2nd International Conference on Intelligent Systems and Image Processing 2014 (ICISIP2014)*, pp. 35-38, 2014.

Prioritizing Usability Factors for Website Usability Improvement: A Case Study of Student Academic Information System at Brawijaya University

Niken Hendrakusma Wardani[1] and Apol Pribadi Subriadi[1]

Abstract–The importance of usability can determine the success or failure of the web application. Conventional approaches of usability evaluation methods only consider the average score from usability assessment which represents the frequency of problems from users when using the website. Another approach to measure the impact of usability factors can be calculated using the method of Partial Least Square. The case study show that combining between this two approaches (average score of usability assessment and impact of usability factors) can be considered for decision makers in prioritizing factors usability.

Index Terms-Evaluation, prioritizing, usability, web application.

INTRODUCTION

Usability is defined by the International Standards Organization (ISO) as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use [1]. In the more specific context of usability website refers to how easy it is to find, understand and use the information displayed on a Website [2]. Good usability can impact on improving the user's convenience, intensity of use and optimize the objective of website. Some companies went bankrupt because it does not consider the usability problems on its web applications [3].

Usability evaluation method is a procedure that is composed by a variety of well-defined activities to collect data usage related to the interaction between end users and software products, and then explain its contribution to achieving the degree of usability [4]. The importance of usability evaluation leads to several of usability evaluation method on web-based information system, for example ServQual, Web-based Service Quality, Usability Heuristics, ISO 9241-10 and UWIS. UWIS combines the dimensions of quality and usability assessment from another method. UWIS has seven dimensions and twenty-four indicators to measure website usability namely reliability, assurance, responsiveness, integration of communication, navigation, controllability and quality of information [5].

Student Academic Information System at Brawijaya University web-based involves many users (students) who have different experience in using website technology. So it is necessary to do usability evaluation for reduce the failure of system usage and user complaints.

Conventional approaches of usability evaluation method using average score from respondent's assessment as the ranking for improvement websites. This approach ignores the presence or absence effect of usability factors on overall usability [6]. Although usability factor has a very low average score but these factors improvements not always have a significant impact. So it is necessary to predict what the most significant factor that affect the overall usability and the same time can explain the causal relationship between overall usability as dependent variable and the usability factors as independent variable.

Path coefficient, as output from Partial Least Square-Structural Equation Modeling (PLS-SEM), explains how strong the effect of one variable is on another variable. The weight of different path coefficient enables to rank their relative statistical importance [7]. Grouping respondents rating using three box methods represent the frequency of users who experience problems when operating the website. Both these measurements (path coefficient and three box method) be presented with a two-dimensional graph can give a clear picture of the sequence most important factors for the improvement of Student Academic Information System (SIAM) at Brawijaya University.

METHODOLGY

Research on usability is one of the researches in the area of Human Computer Interaction (HCI). The focus of this research is the development of a usability evaluation method in the stage of determining priority usability improvements using statistical analysis Partial Least Square and Three Box Method. Figure 1 illustrates the

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framework for making prioritization of usability factors on website usability evaluation.

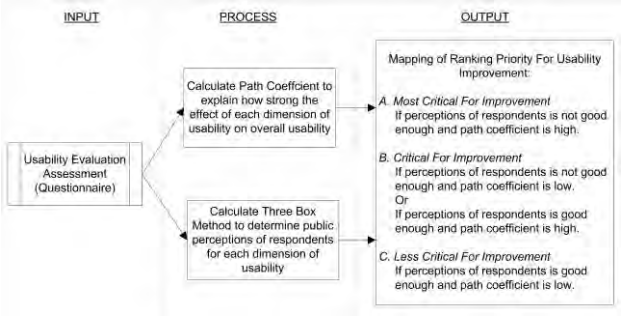

Figure 1. Framework For Making Prioritization.

Data input is a questionnaire of UWIS checklist as a result of usability evaluation assessment. Data input is processed using partial least square method to find the impact ("high" or "low") of each dimension of usability on the overall usability. Besides that, the data is also processed using three box method to determine perceptions of respondents ("not good", "good enough", or "good") for each dimension of usability. As shown in Figure 1 the mapping of ranking priority for usability improvement divided into three quadrants.

RESULT

In this study, 96 students were employed as the respondents of which 50% were female and 50% were male. Respondents are students of Brawijaya University who enrolled in the academic year of 2014/2015 and has attended the lecture for minimum one year so they have more experience for exploring the usage of SIAM. Questionnaire consisted of three tasks to do and 25 questions to answer. This questionnaire was adopted from UWIS assessment as usability evaluation methods. The survey result is processed using three box method to get the index number as frequency of usability problems and is predicted using partial least square method to get path coefficient as the impact of usability factors.

Table 1 shown the result of usability evaluation of website SIAM. There is seven dimensions that using for measuring website usability but three of them, which is integration of communication, navigation, and controllability, are not included in the order of priority because it has the p-value at the PLS-SEM analysis was not significant ($p>0.05$).

TABLE 1. DATA OUTPUT FOR MAKING PRIORITY

Dimension	Index Number	Perception of Respondents	Path Coefficient	Effect to Website Usability
Responsiveness	66.10	Good Enough	0.354	High
Assurance	65.30	Good Enough	0.281	High
Quality of Information	64.33	Good Enough	0.210	High
Reliability	66.27	Good Enough	0.142	Low
Controllability	69.00	Good Enough	0.068	Not Significant
Navigation	65.33	Good Enough	0.061	Not Significant
Integration of Communication	70.27	Good Enough	0.003	Not Significant

Reliability, assurance, responsiveness, and quality of information are the four factors that become priorities for website usability improvements. This factors mapping into three quadrants as shown in Figure 2. The critical factors of usability for improvement are responsiveness, assurance and quality of information that can be a consideration for decision maker to redesign website.

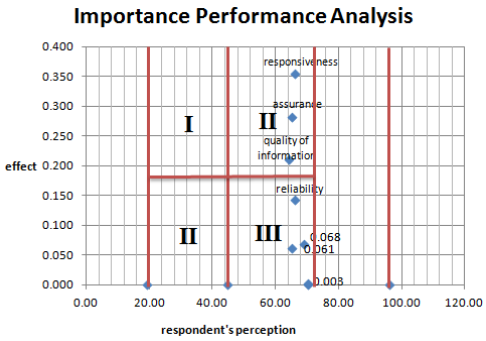

Figure 2. Mapping Of Ranking Priority For Usability Improvement.

CONCLUSION

Based on the results of the case study it can be concluded that the priority of website usability improvements can be made by considering the impact of each usability factor and the frequency of problems based on the perception of respondents.

REFERENCES

[1] ISO 9241-11. (1998). Ergonomic requirements for office work with visual display terminals (VDTs), 28.
[2] Keevil, B. (1998). Measuring the usability index of your web site. *Proceedings of the 16th Annual International Conference on Computer Documentation*, 271–277.
[3] Becker, S. A., & Mottay, F. E. (2001). A global perspective on web site usability. *IEEE Software*, *18*(February), 54–61.
[4] Fernandez, A., Insfran, E., & Abrahão, S. (2011). Usability evaluation methods for the web: A systematic mapping study. *Information and Software Technology*, *53*(8), 789–817.
[5] Oztekin, A., Nikov, A., & Zaim, S. (2009). UWIS : An assessment methodology for usability of web-based information systems. *The Journal of Systems & Software*, 2038–2050.
[6] Oztekin, A. (2011). A decision support system for usability evaluation of web-based information systems. *Expert Systems With Applications*, *38*(3), 2110–2118.
[7] Wong, K. K. (2013). Partial Least Squares Structural Equation Modeling (PLS-SEM) Techniques Using SmartPLS.

Filmless Hospital with PACS as a Workflow Controller, Case Study: National Hospital Surabaya

Romeo[1] and Febriliyan Samopa[1]

Abstract–Traditionally radiology produces a visual representation of medical images in film format for further clinical analysis. While some healthcare providers still used films to display scan results, others are embracing the advancing technology of digital medical images. In radiology, this medical imaging technique is generally equated to filmless radiology. However, modern technology has enabled other clinical areas beyond radiology to use digital imaging, including cardiology, pathology, obstetric and gynecology, orthopedic and dentistry. This widely implementation of filmless system in hospital is known as filmless hospital. This paper discusses filmless hospital using picture archiving and communication system (PACS) as workflow controller as a case study at National Hospital Surabaya.

Index Terms–Filmless hospital, medical imaging, picture archiving and communication system, national hospital Surabaya.

INTRODUCTION

PACS has tremendous and values outside of radiology as well as internally benefits [1]. Generally PACS is adopted in radiology to provide storage and convenient access to filmless radiology images, however, combined with emerging technology, PACS has greater ability to deliver a filmless hospital system.

Filmless hospital is designed to connect all systems and sub-systems installed in a hospital to enable certain stakeholders and users in accessing information resulted from imaging modalities. As a result, this technology has changed the clinical and business aspects of medical imaging in hospitals by delivering substantial cost savings from, improved efficiency and quality, and greater access in an era of high demand and severely constrained resources [2].

FILMLESS HOSPITAL

A filmless hospital that uses PACS as workflow controller is required to involve brokering application to enable PACS communicates with modalities (PACS Broker) and be integrated with other information systems and sub-systems in the hospitals (HL7 Broker). This design is developed using Information Infrastructure (II) approach [3], distinguished by unrestricted number and type of users, interconnection of different systems, modules and applications and dynamic development of system portfolio.

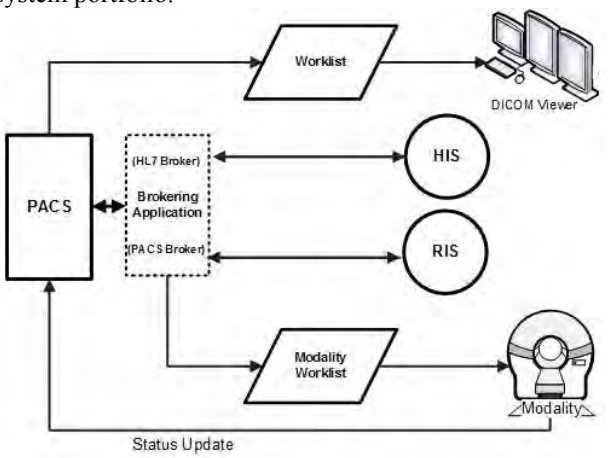

Figure 1. PACS as workflow controller.

Figure 1 illustrates PACS role as workflow controller in filmless hospital, as brokering applications are integrated in PACS. This workflow shows as once a diagnostic appointment is generated, this request is sent through one gate (PACS), before forwarded to modality to produce a work list. As diagnostic appointment is changed (finished or canceled), the information will be communicated through PACS and other associated information systems such as Hospital Information System (HIS) or Radiology Information System (RIS) consecutively. As PACS and RIS have exchanged information to validate the diagnostic results, system will update the work list. Next, the workstation will query data and related medical images to HIS or RIS.

Filmless hospital system has three primary components, including:

I. PACS System

PACS is described as a system that enables acquisition of images and data, storage and display processes are integrated in multiple digital network. In general, a PACS is formed of Client, Modality, Interface and Server. A main server in PACS is functioned as database to store

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digital medical images, which is connected to one or more clients that provide and/or utilise medical images through a local area network or wide area network [4].

II. PACS Broker

The concept of PACS Broker is to enable communication and data and/or information exchange between information systems or applications with imaging modalities that adopt DICOM standard by using WML (Modality Worklist) function and MPPS (Modality Performed Procedure Steps).

III. HL7 Broker

HL7 Broker is application broker designed as hospital information system interface. It has responsibility to translate patient's data into HL7 data format before sent to a system that adopt HL7 standard, for example: HIS, RIS and PACS [5].

SYSTEMS INTEGRATION

Filmless hospital system design in National Hospital Surabaya embraces PACS and existing information systems, HIS and RIS. Integration process for each system to design a filmless hospital system is illustrated in figure 2.

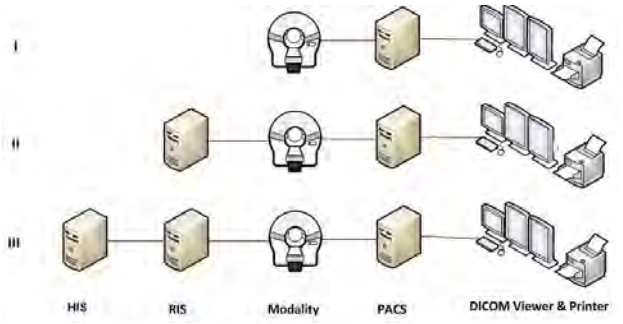

Figure 2. Integration process filmless hospital.

I. Modality is integrated with PACS,
II. Modality that has been integrated with PACS is integrated with RIS,
III. Modality that has been integrated with PACS and RIS is integrated with HIS.

CONCLUSIONS

Developing a filmless hospital requires integration between existing system or sub-system in the hospital and PACS. To succeed the integration, a brokering application and medical standard technology are further requirements. Brokering application is functioned to bridge communication between different systems or sub-systems, while medical standard technology is needed to easily translate data during systems communication, especially when system developers are various.

Specific network architecture implementation in filmless hospital is not necessary except for bandwidth allocation, as medical image files are usually big in size. Compression of medical images is possible to maximize bandwidth usage but image quality should be carefully considered. Compression and decompression method of medical images can be further researched to get better and optimized results

REFERENCES

[1] Bryan, S., et al, "The Benefits of Hospital-Wide Picture Archiving and Communication Systems: a survey of clinical users of radiology services" in *The British Journal of Radiology*, 72(857), pp 469-478, 1999.

[2] Tong, Carrison K.S., *Governanve of Picture Archiving and Communication Systems: Data Security and Quality Management of Filmless Radiology*. New York, NY: Medical Information Science Refference, 2009.

[3] Monteiro, E., et al, "From Artevac to Infrastructure", in *Computer Supported Co-operative Work,* 22 pp 575-607, 2012.

[4] Sujadi, Agus, et al, "Analysis and Design Cloud Computing Architecture for Teleradiology", in *Proceeding Seminar Nasional Manajemen Teknologi XV*, 2012.

[5] Benson, T., *Principles of Health Interoperability HL7 and SNOMED*. New York, NY: Springer, 2010.

Solving Course Timetable Problem By Using Integer Linear Programming (Case Study IE Department of ITS)

Fakher Shwan Rafeek[1] and Nurhadi Siswanto[1]

Abstract–Making IE department of ITS course timetable by determine the hard and soft constraints then develop an integer programming (ILP) model method to solve this NP-complete problem of Timetabling for solving Hard constraints Assignment problem and to solve the Soft constraints use Penalty Algorithm. Use LINGO software for solving suggested mathematical model to get the final results. Then do numerical analyzes for that results. Finally it achieves the goal for solving the Course Timetable. And get feasible solution of timetable as well as it gets the best required objective what it can get from the case study which is 356 events and it reduces the time of getting one timetable to be just one hour after it was at least 2 weeks.

Index Terms-Apply ILP in LINGO software, Assignment Problem, Course Timetable Problem, Integer Linear Programming (ILP), Penalty Algorithm.

INDTRODUCTION

Many institutions (academic, health, transportation, sport, etc.) in the world face timetabling problems (see Figure 1 Timetable classification), Timetabling consists in identifying an optimal allocation of a given set of events (courses, exams, surgeries, sport events) and resources (teachers, exam proctors, nurses, medical doctors) over space (classrooms, operating rooms, sport fields) and time.

The university course timetabling problem is the process of assigning lectures, which are covered by lecturers and attended by students, into 'room–time' slots, taking into account hard and soft constraints.

Timetabling requirements are separated into hard and soft ones. By hard requirements we mean those that must be satisfied, while soft requirements are those that may be violated, but should be satisfied whenever possible. Soft requirements have different levels of importance and are oftentimes conflicting with each other. Thus, it may be impossible to satisfy all of them. Typically, the quality of a solution is associated directly to the satisfaction of soft requirements. The more soft requirements are satisfied, the better a solution is considered[1]

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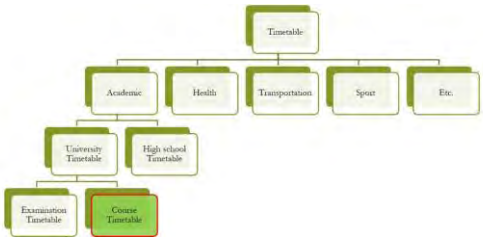


Figure 1. Timetable classifications.

In IE-ITS course timetable problem in that department is solved manually therefore it is taking long time and efforts to finish one timetable each semester which may take 2 weeks' time to finish it beside of that may be there are reviews and corrections after finish it during the semester begging, To Solve this problem we will make automated course timetabling of Industrial Engineering Department (IE) – ITS university and measure how do that feasible solution of that suggested timetable is satisfying the maximum of soft constraints requirements and satisfying also the whole hard constraints.

And to recognize the gab of our research we reviewed several paper journals which is solving the educational course timetables problem so we found some of them concentrated in solving just hard constraints timetable [2] and others they solved just soft constraints timetables [3, 4] as well as others they solved both hard and soft constraints [5-7] etc.

Therefore for summary of gab of our research we will choose:

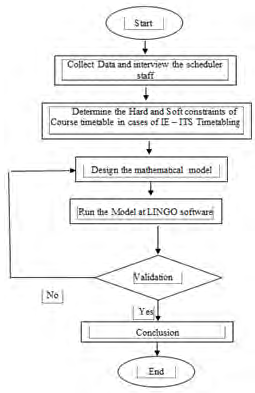
Problem: University Course Timetable.
Methodology: Integer Linear Programming(ILP) (Assignment Problem & Penalty Algorithm)
Case of Study: IE department of ITS
Constraints: Hard and Soft constraints
Objective Function: Minimization

Design Mathematical Model:

- Notation of the mathematical model: Indexes and their resources:

I=COURSE index, And ENORLMENT its resource.
J=CLASSROOM index, And CAPACITY its resource.
K=DAYS index.
L=TIMESLOTNO index.
Decision variables:

$$X_{(I,J,K,L)} \; and \; Y_{(I,J,K,L)}$$



Determine the Hard and Soft Constraints: As shown in research methodolgy figure 2 we started determining Hard Constraints of IE department of ITS: For example each classroom has limited seats capacity which will be given as data input. And for determining Soft Constraints of IE department of ITS: For example the lecturers time wishes to be considered during making the timetable.

Figure 2. Research Methodology.

Every X/Y =1 Means there is event (In that Course, In that Classroom, In that Day, At that Time slot Number)

And if X/Y=0 Means there is no event.

Z=PENALTY decision variable of not applying the soft constraint:

$$Z_{(M)}$$

If Z=1 there is Penalty at that soft constraint.

Otherwise Z=0 there is no Penalty.

M= Soft Constraint no. where each S.C. is numbered.

$X_{(I,J,K,L)}, Y_{(I,J,K,L)} And\ Z_{(M)} = Binary\ 0/1.$

- Mathematical model of Hard Constraints:

Classroom Capacity constraint:

$$\sum_{I}\sum_{K}\sum_{L} Y_{(I,J,K,L)} \geq 0\ ;\ \forall J\ if\ CAPACITY(J) \geq ENORLMENT(I);$$

- Mathematical model of soft constraints:

Preferred course time(e.g. We want to course number 3 to be at Monday and starting at time slot no. 1:

$$\sum_{J}\sum_{K}\sum_{L} Y_{(I,J,K,L)} + Z(M) = 1\ ;\ \forall I\ if\ I = 3, \forall J, K\ if\ K = 1, \forall L\ if\ L = 1, \forall M\ if\ M = 1$$

Validation and Numerical Analysis:

- Hard constraints validation:

Classroom capacity: validation (e.g. Enrolment at the course CO6=40 students and Capacity of the classroom TI108=50 :

Courses	Class	Day	1	2	3
CO6	TI108	TEU	1	1	1

Explanation for the results this event could be held in that classroom because Capacity ≤ Enrolment.

- Soft constraints numerical analyzing:

Preferred Course time (e.g. CO3 at MON at Time slot 1):

Courses	Class	Day	1	2	3
CO3	ID103	MON	1	1	0

Explanation of the result we have event for Course (CO3) in Classroom (ID103) in Day (Monday) and starting at Time slot no. (1).

CONCLUSION

1. For Hard constraints we used Assignment Problem method and to solve the Soft constraints we used Penalty Algorithm method and both of them consider as (0 – 1) implications of Integer Linear.
2. After one Hour of Running the IE-ITS Model we interrupted it and we got results of that timetable which was not the Best Feasible Solution(BFS) but we got our best required objective for our model: 356 without any Penalties(Z=0) of not applying the Soft Constraints and the Results displayed that we applied the maximum of Soft constraints and whole Hard constraints with Number of Constraints: 71704 and the total of decision variables of: 156013 which is distributed between (X, Y and Z) and number of Nonzeros was: 562706 and the last Iteration was: 5428124.
3. Numerical Analyzing of Results shown that whole H.C. is working, And S.C. is working, But Some of it is not working properly.
4. Reduce spending time and efforts of IE-ITS timetable to be just 1 hour after it was at least 2 weeks.

REFRENCES

[1] Árton P. Dorneles, i.C.B.d.A.a.L.S.B., A fix-and-optimize heuristic for the high school timetabling problem. Computers & Operations Research, 2014. 52.

[2] Thongsanit, K., Solving the Course - Classroom Assignment Problem for a University. SILPAKORN UNIVERSITY SCIENCE AND TECHNOLOGY JOURNAL, 2013.

[3] Edmund K. Burke, J.M.c., Andrew J. Parkes, Hana Rudová, Decomposition, reformulation, and diving in university course timetabling. Computers & Operations Research, 2010. 37.

[4] Yuri KOCHETOV, P.K., Mikhail PASCHENKO, FORMULATION SPACE SEARCH APPROACH FOR THE TEACHER/CLASS TIMETABLING PROBLEM. Yugoslav Journal of Operations Research, 2008. 18.

[5] Patrick De Causmaecker, P.D.a.G.V.B., Evaluation of the University Course Timetabling Problem with the Linear Numberings Method, 2008.

[6] Antony E. Phillips, H.W., Matthias Ehrgott and David M. Ryan, Integerprogramming methods for large-scale practical classroom assignment problems. Computers & Operations Research, 2014.

[7] Patrick De Causmaecker, P.D.a.G.V.B., A decomposed metaheuristic approach for a real-world university timetabling problem. European Journal of Operational Research, 2009. 195.

Signal Enhancement by Single Channel Source Separation

Bagus Tris Atmaja[1] and Dhany Arifianto[1]

***Abstract*—Most gadgets and electronics devices are commonly equipped with single microphone only. This is difficult task in source separation world which traditionally required more sensors than sources to achieve better performance. In this paper we evaluated single channel source separation to enhance target signal from interred noise. The method we used is non-negative matrix factorization (NMF) that decompose signal into its components and find the matched signal to target speaker. As objective evaluation, coherence score is used to measure the perceptual similarity from enhanced to original one. It show the extracted has 0.5 of average coherence that shows medium correlation between both signals.**

***Index Terms*— Signal enhancement, source separation, NMF, coherence.**

INTRODUCTION

Signal enhancement has been applied widely in electronic devices, from land line phone to smartphone. Commonly, it used noise suppression method which attempt to remove background noise from target signal. Moreover, the active noise cancellation or active noise control (ANC) required more than one sensor for telephony, one to capture background noise and another to speak via telephone. However, most gadgets at this time, including smartphone, tablet or laptops is only equipped with single microphone. This makes not easy to implement such noise suppression method built in devices.

Source separation, in other side is challenging problem, especially in signal processing communities and applied widely including in audio/acoustic signal. This problem progressively improved from unblind to blind, from supervised to unsupervised, and from overdetermined to underdetermine source separation. In blind source separation, almost no prior information is used to decompose mixed signal likewise in unsupervised source separation. In the other hand, early source separation method used prior information like number of source and sensors, geometry information, time delay and others, this is previously stated unblind or supervised source separation.

Overdetermined source separation is condition where number of sensors more than number of sources. Mathematically, it will give more information compared to underdetermined source separation, where number of sensors less than number of sources. Underdetermined source separation is actively improved, inspired by human binaural ears, and continued developed to reduce the number of sensors. Currently, researchers [1] are investigate to expand underdetermined source separation to single channel source separation as breaking old source separation rule, number of sensor must be greater than sources.

The problem of underdetermined and single channel source separation is about how to decompose small matrix to reconstruct bigger matrix after decomposition. As the signal becomes matrix in computational method, the solution is mathematic matrix manipulation. The widely used matrix decomposition to solve this problem is known as non-negative matrix factorization (NMF).

Virtanen [1] proposed non-negative matrix factorization to solve underdetermined source separation. While their proposal is implementation of NMF for source separation, this paper evaluate NMF for audio signal speech enhancement from single channel recording. This work is the continuity of our previous work [2], while the previous one used two sensors, this research used one sensor only to extract target signal. For evaluation the performance of enhancement by single channel NMF source separation, we used coherence score. Coherence measurement is usually used to measure the quality of processed (enhanced) signal compared to original clean signal or coherence measures how well signal correlated to each other.

METHOD

A. Simulation

Data used in this research can be obtained by simulation and experiment to get mixture sound. For simulation, modeling sound mixture is done by convoluting sound signal with room impulse response which is called convolution reverb. Anechoic room is used to minimize noises and assume no noises in simulation. In this research we evaluated sine sweep sound to measure room impulse response. Measured impulse response then convoluted with source signal to reproduce sound signal in anechoic room.

Room impulse response can be measured by generating sine sweep (s(t)),

$$s(t) * h(t) = r(t) \quad (1)$$

where h(t) is measured impulse response. We use Aliki software to generate sine sweep, measure sine sweep response and room impulse response.

Measured impulse response can be used to produce simulated acoustic mixture by convoluting it with sound sources (s(t)) by the following model,

$$x(t) = \sum_{1}^{n} S_n(t) * h(t) \quad (2)$$

where x (t) is simulated sound from convolution reverb. The waveform of this reproduced sound can be seen in figure 2 (left).

Data in the form of sound signal from multiple sources are obtained from simulation and experiment can be obtained through the following steps:

1. Generate sine sweep signals

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2. Capture sine sweep response
3. Obtain impulse response
4. Convolute sound source with impulse response

While step 1 to step 3 is done with Aliki software, step 4 is done with Matlab.

The configuration for sweep signal generation is as follows: 48000 Hz of sampling rate, 0.1 seconds fade in frequency range from 20 Hz - 20 KHz, 0.003 fade out. Obtained impulse response with 48 kHz of sampling rate is downsampled to 16 kHz because our focus is audible sound and to match other signals.

B. Experiment

An experiment is conducted to validate simulation data. To evaluate modeled acoustic mixture, sound recording is recorded. Two speeches with same utterances from female and male speech are recorded along with background noises.

Experiment set up consists of two loudspeakers, one microphone and a personal computer. The distance between sound sources (loudspeakers) to microphone is 100 cm, and space between loudspeakers is 75 cm. For recording, we use Audacity running on Linux-based operating system. In experiment, 16 kHz of sampling frequency and 16 bit PCM is used to record sound from two loudspeakers. The two different sound files are transmitted into two loudspeaker as simulated by convolution reverb. The recorded sound waveform is compared to simulation data. The room dimension is 3.5 x 3 x 3 (length x wide x height, in meter).

C. Separation Principle

Source separation is the core of this work after modeling sound mixture. Separation principle consist of the following steps:

1. STFT
2. NMF (Non-negative Matrix Factorization)
3. FILTER (Masking)
4. ISTFT

The flow of those steps can be organized by the following block diagram. That Figure shows the decomposition of signal **x** into $\mathbf{x}_1$, $\mathbf{x}_2$ and $\mathbf{x}_s$. This explains how single channel source separation works.

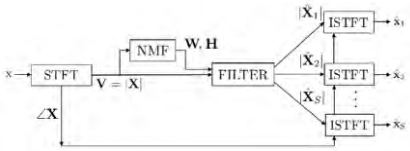

Figure 1. Diagram block of single channel source separation using KL-NMF [3].

RESULTS AND DISCUSSION

By modeling sound mixture and conducting experiment from single channel, signal enhancement can be done by source separation method. This single channel source separation utilize Kullback-Leibler divergence NMF (KL-NMF). The first result is to analyze the simulation and experiment data (convolution reverb) by comparing both signals as shown in Figure 2. The reproduced signal from model is similar to recorded signal from experiment. However, the similarities between both decreased along with time axis or there is time lag between both.

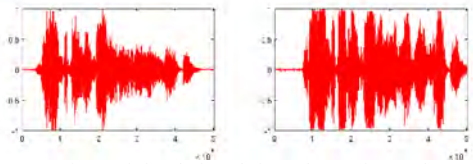

Figure 2. Waveform of simulation (left) and experiment data.

Measuring signal similarities also can be done more precisely by cross-correlating signal from convolution reverb to recorded sound. The present of high peak shows correlation between them. The difference between peak and zero x-axis is time lag of both signal i.e. -3786 samples or -0.24 second which signal from experiment appears first from simulation data.

For the extraction, we use matrix decomposition with Non-negative Matrix Factorization (NMF) algorithm. The signals from multiple sources is captured by single sensor and using NMF algorithm, it can be decomposed to extract the first source. Figure 3 shows the spectrogram (plot of time-frequency) original and extracted signal (mixed signal is not shown). It is found that average coherence between both is 0.5 or there is medium correlation between original and extracted signal. The coherence is obtained after aligning signals via cross correlation.

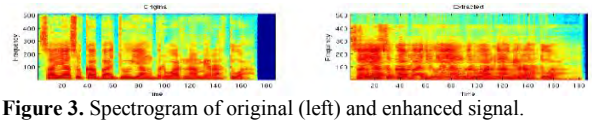

Figure 3. Spectrogram of original (left) and enhanced signal.

CONCLUSION

This research evaluate modeling sound mixture in anechoic room compared to experiment data and its separation of target signal from multiple sources. The model shows similarity of experiment data from waveform and measured by cross-correlation and coherence between extracted and original signal. On the experiment data, the amplitude shows bigger than simulated signal while the extracted signal has more sample points (x-axis) compared to original one.

REFERENCES

[1] Ozerov, Alexey, and Cédric Févotte. "Multichannel nonnegative matrix factorization in convolutive mixtures for audio source separation." Audio, Speech, and Language Processing, IEEE Transactions on 18.3 (2010): 550-563

[2] B.T. Atmaja, D. Arifianto, Y. Chisaki, T. Usagawa. "Signal Enhancement by Using Sound Separation Methods Based On Binaural Inputs." Basic Science Int. Conf., 1-5. 1 (3), 2012.

[3] Nicholas Bryan, Dennis Sun, and Eunjoon Cho, "Single-Channel Source Separation Tutorial Mini-Series" [online] 2015.

A Hybrid Approach Support Vector Machine (SVM) – Neuro Fuzzy For Fast Data Classification

Elsen Ronando[1], M. Isa Irawan[1], and Erna Apriliani[1]

Abstract-In recent decade, support vector machine (SVM) was a machine learning method that widely used in several application domains. It was due to SVM has a good performance for solving data classification problems, particularly in non-linear case. Nevertheless, several studies indicated that SVM still has some inadequacies, especially the high time complexity in testing phase that is caused by increasing the number of support vector for high dimensional data. To address this problem, we propose a hybrid approach SVM – Neuro Fuzzy (SVMNF), which neuro fuzzy here is used to avoid influence of support vector in testing phase of SVM. Moreover, our approach is also equipped with a feature selection that can reduce data attributes in testing phase, so that it can improve the effectiveness of time computation. Based on our evaluation in real benchmark datasets, our approach outperformed SVM in testing phase for solving data classification problems without significantly affecting the accuracy of SVM.

Index Terms – Support Vector Machine (SVM), Neuro Fuzzy, Classification, Computation Time.

INTRODUCTION

Machine learning was one of many areas in artificial intelligence that widely applied for decision-making process. In general, the aim of machine learning technique was to analyze the data for making the model and knowledge that can be used to predict the future behavior of the data. Nowadays, most popular of machine learning technique is support vector machine (SVM) method, where this method has a high accuracy [6] and widely applied in many application, such as text categorization, digit recognition, time series prediction, financial forecasting, pattern selection, and voice recognition.

The principle of support vector machine (SVM) is searching optimal margin hyper plane to divide some different classes. It means that the dataset are classified according to its class based on the best hyper plane which built through the training phase. Although the results of SVM showed an accuracy higher than other methods in testing phase, such as neural networks. Yet, some studies literature indicated that SVM still has some problems, especially highly computational time of the testing phase [6]. It was due to SVM in the testing phase is strongly influenced by the increasing number of support vector if the data has huge dimensions.

Based on these problems, we proposed a hybrid approach SVM – Neuro Fuzzy (SVMNF), which Neuro Fuzzy that applied here has been integrated with feature selection. Thus, it can significantly reduce the data dimension for decreasing computation time in testing phase. The methods and the results of our evaluation will be explained more details in the next section.

METHODS

In this section, we describe our approach to improve the efficiency of the computing time in the testing phase of SVM. In our concept, the framework of our approach can be illustrated in Figure 1.

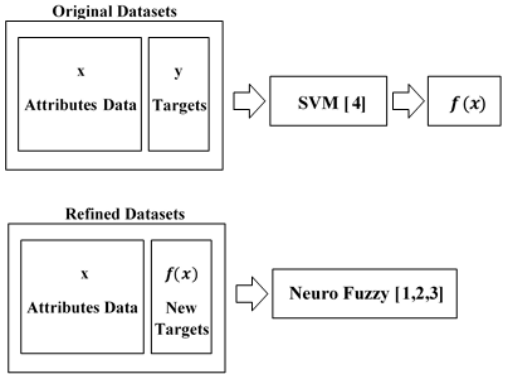

Figure 1. Framework Of Our Approach.

Based on the Figure 1 above, datasets are trained using SVM method that offered by [4]. Then, the value of the estimated function $f(x)$in the training phase of SVM is used to refine the first attributes data. Thus, it is obtained data attributes and a new target which is then used for the training process neuro fuzzy. Neuro fuzzy method used here is a neuro fuzzy method based on linguistic hedge integrated with the principles of feature selection [1,2,3]. The results of feature selection and weighting of neuro fuzzy training process then is used for predicting new datasets.

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RESULTS

In our evaluation, we implemented our algorithm on a laptop 2,40 GHz Intel Core i5-520M with 4 GB of RAM using MATLAB R2012b. Moreover, we also conducted our experiments with 10 dataset for classification problems [5], such as iris, wine, sonar, glass, ionosphere, breast cancer, vehicle, vowel, yeast, and segment. Each dataset was divides into 70% for training phase and 30% for testing phase. In addition, some datasets were normalized into range [-1,1]. For kernel function, we used two types of kernel functions, such as Gaussian radial basis function and exponential radial basic function.

The following is a comparison of error rate between SVM and our approach that illustrate in Table 1.

TABLE 1. A COMPARISON OF ERROR RATE.

Dataset	Dimension Data	SVM Error (%)	SVMNF Error (%)	Difference Error (%)
Iris	[150x 4]	4	0	4
Wine	[178x13]	1,9231	1,9231	0
Sonar	[208x59]	54,8387	54,0323	0,8064
Glass	[214 x 9]	40	35,3846	4,6154
Ionosphere	[351x34]	5,7143	5,7143	0
Breast Cancer	[683x9]	0,9756	0,8293	0,1463
Vehicle	[846x18]	34,252	34,133	0,199
Vowel	[990x8]	58,2492	49,293	8,9562
Yeast	[1484x8]	39,72	48,72	9
Segment	[2310x19]	12,6984	17,922	5,2236
Average	-	-	-	3,3

Meanwhile, the results of the comparison of the two approaches for computation time in the testing phase can be shown in the Table 2.

TABLE 2. A COMPARISON OF COMPUTATION TIME.

Dataset	Dimension Data	SVM Runtime (second)	SVMNF Runtime (second)	Reduction Runtime (%)
Iris	[150x 4]	0,6208	0,039	93,71
Wine	[178x13]	0,6988	0,123	82,39
Sonar	[208x59]	0,5366	0,5194	3,205
Glass	[214 x 9]	2,6504	0,110761	95,82
Ionosphere	[351x34]	1,2074	0,0670	94,45
Breast Cancer	[683x9]	3,5349	0,145	95,89
Vehicle	[846x18]	15,2506	8,7766	42,45
Vowel	[990x8]	84,37	11,1775	86,75
Yeast	[1484x8]	140,3605	73,1566	47,87
Segment	[2310x19]	255,296	229,2256	10,21
Average	-	-	-	65,2745

CONCLUSIONS

Based on the results of our evaluation in several cases of classification datasets, our approach showed better performance than SVM for improving the effectiveness of testing computation time. Our approach also significantly is not affecting the accuracy of SVM itself. It is caused by SVM and Neuro Fuzzy in training phase which are capable of searching the best hyper plane and reduce overlapping class. Although our approach presented a good performance, but it still has some drawbacks, such as the high computation time of the training phase. It is due to two training process, such that SVM and Neuro fuzzy as illustrated in Figure 1. Moreover, our approach also still use random process for selecting input parameters. It means the required additional algorithm that is able to search the best parameters input for increasing their performance. Noise filtering method can also be added for future work in this approach to reduce the complexity of data in preprocessing phase.

ACKNOWLEDGEMENTS

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REFERENCES

[1] B. Cetisli, "Development of an adaptive neuro-fuzzy classifier using linguistic hedges: Part 1," Expert Syst. Appl., vol. 37, no. 8, pp. 6093–6101, 2010.

[2] ——, "The effect of linguistic hedges on feature selection: Part 2," Expert Syst. Appl., vol. 37, no. 8, pp. 6102–6108, 2010.

[3] B. Cetisli and A. Barkana, "Speeding up the scaled conjugate gradient algorithm and its application in neuro-fuzzy classifier training," Soft Comput., vol. 14, no. 4, pp. 365–378, 2010.

[4] C. Hsu and C. Lin, "A comparison of methods for multiclass support vector machines," IEEE Transactions on Neural Networks, vol. 13, no. 2, pp. 415–425, 2002.

[5] K. Bache and M. Lichman, "UCI machine learning repository," 2015. [Online]. Available: http://archive.ics.uci.edu/ml

[6] S. Kang and S. Cho, "Approximating support vector machine with artificial neural network for fast prediction," Expert Syst. Appl., vol. 41, no. 10, pp. 4989–4995, 2014.

Comparative Study on Data Mining Methods in Structural Reliability Prediction

Willy Husada[1], I-Tung Yang[2], and Tri Joko Wahyu Adi[1]

Abstract–The goal of reliability-based design optimization (RBDO) is to find the optimal structure design with minimum cost subjected to maximum failure probability limit. Since failure probability is usually small, it takes a large amount of computation time for accurate estimation in reliability analysis. Surrogate models usually created to replace the time-consuming reliability analysis. In this empirical study, we use several data mining methods with focus on classification and regression tree (CART), artificial neural network (ANN) and support vector machine (SVM) method to create the surrogate models on a empirical benchmark case study. We aim to find the best data mining method in predicting the failure probability which divided into two parts: classification and regression. The main findings of this study is that CART method performed better than ANN and SVM in both classification and regression. Support vector machine (SVM) method is the worst in both cases.

Index Terms – data mining, failure probability, reliability-based design optimization, surrogate model.

INTRODUCTION

Design quality is an important part in the structural construction project. A structural designs should produce a structure that is reliable enough subjected to uncertain conditions such as variability from construction process, material properties and external loads. Design optimization is used to improve the design quality so that the actual structure can have adequate safety with minimum cost. One of the most popular design optimization methods is reliability-based design optimization (RBDO). RBDO has two processes, design optimization and reliability analysis which aim to find the optimal design with minimum structure cost or weight subjected to maximum failure probability limit. In practical, RBDO involves highly non-linear limit state functions and non-normally distributes distributed random variables. These issues create challenges for accurate reliability analysis [1].

There are three integration frameworks of RBDO: double-loop, single-loop and decoupled. The double-loop method requires a full reliability analysis at every step of the design optimization process and too computationally expensive for practical application [2]. In single-loop method, a surrogate model is created to replace the time-consuming reliability analysis [3]. Despite the enhanced efficiency, the single-loop method may be inaccurate in estimating the structure failure probability because the surrogate model is associated with certain errors. Decoupled method divides double-loop method into sequential cycles and them improve the reliability by formulating a new optimization constraint in the next cycle for violated reliability constraints [4].

To improve the accuracy of the single-loop RBDO method, a better surrogate model is needed. Data mining through artificial intelligence (AI) based methods can provide a better surrogate model to predict the structure failure probability. This study attempts to implement several data mining methods to construct surrogate model in RBDO problem and has a main objective to find the best data mining method in predicting failure probability from a structural design. The prediction is divided into two parts, binary classification and regression. Binary classification model is focusing on minimization of cost while regression model is focusing on minimization of cost and failure probability. The proposed RBDO surrogate models is validated through a empirical benchmark case study which is ten-bar truss problem to demonstrate the prediction accuracy and computation time of proposed RBDO framework.

METHODS

The specific steps of this study are as follows:

1) Perform literature review related to data mining and RBDO.
2) Adopt the ten-bar plane truss to be the experimental case.
3) Use Monte Carlo Simulation (MCS) to conduct reliability analysis for preparing training data set.
4) Conduct preliminary experiments to select the best-three data mining methods among popular AI algorithms in the estimation of reliability.
5) Develop surrogate models based on the theories of CART, ANN and SVM.
6) Fine-tune the control parameters of the ANN and SVM data mining methods. CART method does not have any time-consuming parameter-tuning.
7) Evaluate the surrogate models performance using ten-fold cross validation in terms of prediction accuracy and computation time.

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8) Compare the surrogate models and find the best data mining method in failure probability prediction.
9) Draw the study conclusions based on the experiment results.

CASE STUDY AND RESULT DISCUSSION

The benchmark case used in this study is a ten-bar plane truss problem. The shape, geometry and loading of the ten-bar truss structure are shown in Fig. 1. The ten-bar truss is pin-jointed and subjected to two external loads, P_1 and P_2. Every bar is made of hollow carbon steel pipes and may have different sizes. The selection of bars represents a discrete set with three features: pipe outside diameter (D), wall thickness (t) and cross-sectional area (A). In total, there are 36 discrete options that can be selected from the list and these options form a design space of 36^{10} discrete combinations which is more than 3.65×10^{15} options. This amount of possible options is considered huge for a relatively small RBDO problem.
We perform a series of preliminary experiments to choose the best surrogate models and conduct more detailed on these models. We use SPSS Clementine 12.0 to perform preliminary experiments because it is packaged with several popular data mining algorithms for both classification and regression. At first, there are seven methods for classification and four methods for regression. After conducting the preliminary experiments, the best three data mining methods for both classification and regression problem are CART, ANN and SVM.

We finally create surrogate models using three data mining methods: CART, ANN and SVM. The settings and types of each method in Matlab are as follows:

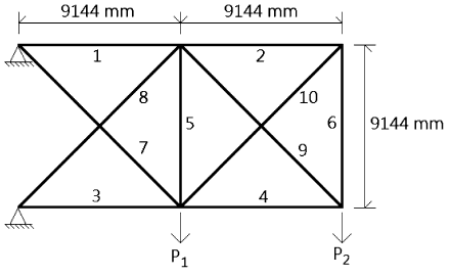

Figure 1. Ten-bar truss geometry and loading.

1) CART: Gini Index as Impurity Measurement
2) ANN: 3 Hidden Layers, 5 Neurons @ Hidden Layer, Scaled Conjugate Gradient Method (Classification), Levenberg-Marquardt Method (Regression), Log-Sigmoid Transfer Function
3) SVM: Least Square Support Vector Machine (LSSVM), RBF Kernel, Regularization Parameter Value (γ) = 0 to 1, Kernel Parameter Value (σ) = e^{-10} to e^{10}

There are eighteen classification models and eighteen regression models created during this process forming a total of thirty-six surrogate models. The main findings of this study is that CART performed better than ANN and SVM in both classification and regression. SVM method is always the worst in both cases. Table. 1 shows the accuracy of all models in classification and regression.

TABLE 1. ACCURACY OF ALL THE THREE MODELS IN CLASSIFICATION AND REGRESSION

Data Mining Method	The Accuracy and Performance of the Surrogate Models	
	Classification Model Accuracy	Regression Model MAPE (Error)
CART	93.86%	39.24%
ANN	92.89%	40.83%
SVM	87.03%	72.63%

REFERENCES

[1] K. Deb, *Multi-objective optimization using evolutionary algorithms.* New York: Wiley, 2001.

[2] R. Yang and L. Gu, "Experience with approximate reliability-based optimization methods," *Structural and Multidisciplinary Optimization*, vol. 26, pp.152–159, 2004.

[3] D. Steenackers et al., "Reliability-based design optimization of computation-intensive models making use of response surface models," *Quality and Reliability Engineering International*, vol. 27, no.4, pp.555–568, 2011.

[4] K. W. Liao and C. Ha, "Application of reliability-based optimization to earth-moving machine: hydraulic cylinder components design process," *Structural and Multidisciplinary Optimization*, vol. 36, pp.523–536, 2008.

Distortion Inspection System Development of Rearview Mirror using Radial Line Method Based on Image Processing

Detak Yan Pratama[1], Apriani Kusumawardhani[1], Aulia M T Nasution[1], Andi Rahmadiansyah[1], and Achmadi[1]

Abstract - Quality control is one of the important steps in production process of rearview mirror industry. This activity can be in the form of product inspection. As an essential component of vehicle, rearview mirror must be observed especially in distortion assessment. During this time, the assessment of rearview mirror product is finished by experts. Thus, faults of inspection can be occurred. These faults could be caused by a decrease of accuracy which is an effect of eyes tiredness. The technique of image processing method is observed to solve this inspection problem. This study is proposed to construct the distortion inspection system on rearview mirror by using radial line method based on image processing.

Index Terms – Radial line method, image processing, distortion and rearview mirror.

INTRODUCTION

Assessment of rearview mirror through this study is prepared in open space. Web camera is used to capture the mirror image in conditioned lighting environment. This captured image will be sent to the personal computer to be processed by using radial line method and other image processing. Through the process, the distortion factor value can be acquired. Then, this distortion factor value will be compared to Indonesian Standard of Distortion value of rearview mirror to determine if the product appropriate to the standard or conversely. According to Indonesian Standard, the distortion factor value is 7 thus the separation of rearview mirror can be done. The following process in this study is generating an automatic detection system by online using open source software to simplify the algorithm.

METHOD OF RESEARCH

As the hardware, this study use controller and mechatronics system which consist of mechanical and electronic system. The components of mechanical system are rearview clamp, torsion gear, mounts hole, moving arm, static cam and connecting rod. The electrical systems consist of servo, SPS, Wiring and PCB. Servo is a rotary actuator that can be control angle position, velocity and acceleration correctly. Servo consist several component which are high torsion motor DC and gearbox which is compiled to sensor for position response feedback. Therefore, it needs accomplished module to control the servo. SPS is a power supply which is equipped by regulation switch and called power supply switching. The power supply switching has excellence with high efficiency up to 85%. Wiring is utilizing to connect the controller to other components. Controller must be connected to the other controller, servo and personal computer. To assemble the PCB, it needs Computer Aided Design (CAD) software and PCB manufacture. For capturing the rearview mirror image, this study use Camera Logitech C920.

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The experimental hardware set up can be shown in Figure 1. Radial line pattern in as shown in Figure 1 are the lines which are separated angel of 15^0. This pattern can be shown in Figure 2.

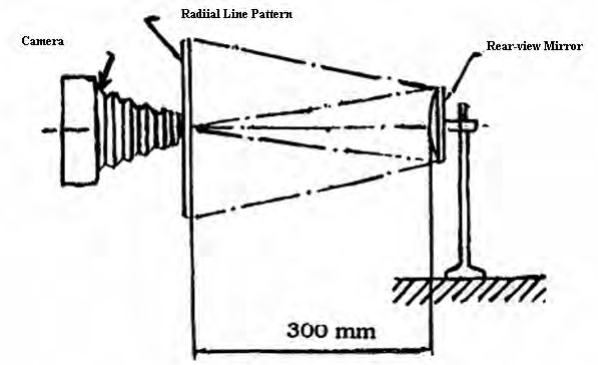

Figure 1. Experimental of Rear-view Inspection Set Up.

Software which applies to this study is GNU Octave which can be used to process high level numerical computation such as image processing. GNU Octave contain feature which can solve the linear and non linear problem including numerical experiment. Moreover, Octave is also accomplished by graphical sophisticated capability to process data visualization and manipulation. Besides, script of Octave program is similar to the Matlab software, thus it can be used both of them.

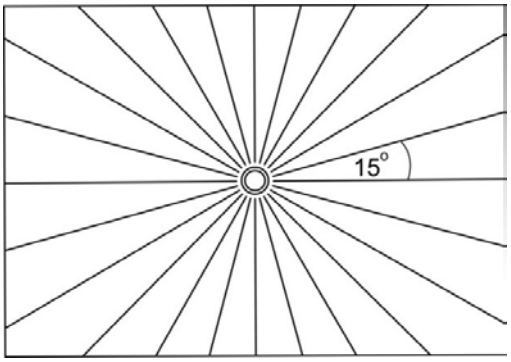

Figure 2. Radial line pattern.

RESULT AND ANALISYS

The result of this study shows that estimation of distortion factor value can be evaluate automatically, easier, cheaper, quick and accurately. There are 15 samples which had been investigated through this study. The distortion factor results can be shown on Table 1.

TABLE 1. DISTORTION FACTOR OF INVESTIGATED SAMPLES.

No	Types	Distortion
1	AR1	2,82438
2	AR2	2,73756
3	AR3	1,95244
4	AR4	2,52062
5	AR5	2,44262
6	BL1	2,486
7	BL2	2,01714
8	BL3	2,31116
9	BL4	2,7586
10	BL5	2,26026
11	BR1	2,51006
12	BR2	4,07896
13	BR3	2,55146
14	BR4	2,45096
15	BR5	1,99014

From this experiment, it can be evaluated the distortion value in range of 1.95244 to 4.07896 with precision of 10^{-5}. It can be verified that all of the rear-view samples had been fulfilled the Indonesian Standards, which mentioned that maximum distortion factor of rearview mirror is 7. Thus, this innovation can facilitate rearview mirror industry to enhance the quality product assessment if compared to conventional method.

CONCLUSION

1. Radial line method can be used to determine distortion factor of rear-view mirror
2. Rear-view from Honda Spare Part have been fullfiled SNI 2770.2:2009

REFFERENCES

[1] A.Kusumawardhani, H. Setijono, M. T. Nurismu, Irwansyah, Sekartedjo. *An Application of Concentric Circle Method for Detection of A Rear View Mirror Distortion*, The 5th Indonesia Japan Joint Scientific Symposium (IJJSS), Nishichiba Campus, Chiba University, Japan, October 25-28 2012.

[2] AIS 001 / 2001, *Automotive Vehicles - Rear - View Mirrors - Specification*, Automotive Industry Standard. Hal 22-23, 2001.

[3] Fitri Rahmah, A.Kusumawardhani, H. Setijono, A. M. Hatta, Irwansyah, *Radial Line Method for Rear View Mirror Distortion Detection*, International Seminar on Photonics and Its Applications, Sanur, Bali, Oct. 2014.

[4] Purnomo Mauridhi Hery dan Arif Muntasa. *Konsep Pengolahan Citra Digital dan Ekstraksi Fitur*. Graha Ilmu, 2010.

[5] Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing*, Addison-Wesley Publishing, 2002.

[6] SNI 2770.2, *Kaca Spion Untuk Kendaraan Bermotor Kategori L*, Badan Standardisasi Nasional, 2009.

[7] TSC3901G, *Radial Line Method*, Toyota Engineering Standard. Hal 10-11.

[8] Warren J.Smith, *Modern Optical Engineering*, McGraw-Hill, USA, 1966.

Sliding Mode Control System of Single Phase Buck-Boost Inverter with Buffer Inductor

Purwadi Agus Darwito[1], Arief Abdurrakhman[1], and Almas Fachrullah[1]

***Abstract* - *Inverter is one of the primary components of a distributed electric power plants that serve as modifiers DC voltage into AC. In this research is applied of the Sliding Mode Control on Inverter Buck Boost One phase with Buffer Inductor. In the Open Loop test with the source voltage of 60 Volts, generate graphics output voltage in the form of a sinusoidal wave with maximum amplitude of about 400 volts. In the Closed Loop test, the graph output voltage can be controlled to follow a set point with SMC control method of order 2, and the resulting value Error Steady State smallest at 300 Volt, which* amounted to 3.33%. The smallest sensitivity value of 0.29 when the input voltage changes by 32%.**

Index Terms* - *Inverter, SPBBI-BI, sliding mode control

INTRODUCTION

In the distributed generator system (DG-system) of electrical power needed to control the inverter output voltage despite energy sources and the existing load fluctuates. There are various types and inverter topologies that have been used, one of new inverter topology is a single phase Inverter Buck Boost with buffer inductor. The advantages of this type is the inverter can produce output voltage value is almost 2 times the given input voltage and suitable for use as an induction motor drives are typically used in electric cars [1]. For the purpose of controlling the output voltage of the inverter takes the appropriate control system. In this research, the type of control system applied Sliding Mode Control (SMC). Sliding Mode Control (SMC) is one commonly used control method for nonlinear systems and switching systems or non-continuous. This method is widely used in control systems Converter, Inverter, Motor and Robotics System. Sliding mode control also has a robust nature that is insensitive to changes in the parameters [2]. based on the characteristics of the SMC, the SMC method used in this research so that the system can be be controlled properly. Some parameters were achieved in this research is able to follow the setpoint output voltage, output voltage is generated having Error steady state (Ess) and Over shoot low and the output voltage has a low sensitivity level also if there change of the input voltage and load values given.

METHOD

The method used in this research are as follows :

A. The Model Plant of Inverter Buck Boost One Phase with Buffer Inductor System Without a Controller

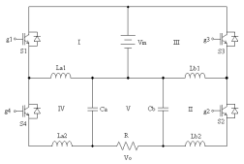

Figure 1. Plant circuit Inverter Buck Boost One phase with Buffer Inductor.

Case 1

This condition occurs if the S1, S2 ON and S3, S4 OFF. Then obtained the equivalent circuit of Figure 1, and from the circuit obtained in the form of state space models for case 1 are:

$$\begin{bmatrix} \frac{di_{Lb}}{dt} \\ \frac{dV_{Cb}}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{L_1+L_2} \\ \frac{-1}{C_b} & \frac{1}{RC_b} \end{bmatrix} \begin{bmatrix} i_{Lb} \\ V_{Cb} \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{-1}{RC_b} \end{bmatrix} V_{Ca} \quad (1)$$

Case 2

This condition occurs if the S1, S2 OFF and S3,S4 ON. Then obtained the equivalent circuit of Figure 1, and from the circuit obtained in the form of state space models for case 2 is :

$$\begin{bmatrix} \frac{di_{La}}{dt} \\ \frac{dV_{Ca}}{dt} \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{L_1+L_2} \\ \frac{-1}{C_a} & \frac{1}{RC_a} \end{bmatrix} \begin{bmatrix} i_{La} \\ V_{Ca} \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{-1}{RC_a} \end{bmatrix} V_{Cb} \quad (2)$$

B. The Design of The Controller Inverter Buck Boost One Phase with Buffer Inductor Using SMC

1. Determination the state of the controlled variable

There are two variables are controlled, the output voltage error (e) and changes in voltage error (de/dt). The equation is:

$$\begin{bmatrix} \dot{x1} \\ \dot{x2} \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -\frac{1}{CL} & 0 \end{bmatrix} \begin{bmatrix} x1 \\ x2 \end{bmatrix} + \begin{bmatrix} 0 \\ \frac{Vca+Vcb}{CL} \end{bmatrix} u + \begin{bmatrix} 0 \\ \ddot{Vref} + \frac{Vref}{CL} - \frac{Vcb}{CL} \end{bmatrix} \quad (3)$$

Where : $x1 = e = error; x2 = \frac{de}{dt} = error\ rate;$

$u = control\ signal\ from\ SMC; Vref = reference\ voltage$

2. Determination of sliding surface and control theorem SMC

Sliding mode control is a control method that is widely used for non-linear control system including the control of power electronics systems such as power converters, inverters, active filters, and so forth. The main advantages of sliding mode control is to have robust nature so that it can cope with the control system parameters tend to change [3].

Sliding Surface on the phase plane variable state also determined that the controller can achieve the desired response. The equation of the sliding surface [4] are:

$$S = kx1 + x2 \quad (4)$$

Where : S : Sliding Surface; k : Sliding Coefficient

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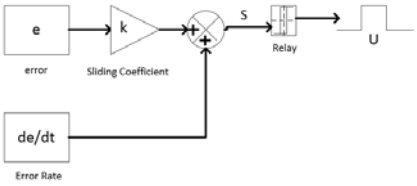

Figure 2. Block Diagram SMC.

3. Achievement and circumstances of SMC

Controller that has been designed considered successful when they fulfill two main properties of SMC methods, that is the achievement and circumstances. For achievement of SMC by the equation:

$$\dot{V}(t) = -x.V(o).\exp(-xt) \qquad (5)$$

for a state of SMC based on the equation:

$$S > 0 \rightarrow \dot{S} < 0 \rightarrow k\left(\dot{Vo} - \dot{Vref}\right) + \left(\ddot{Vo} - \ddot{Vref}\right) < 0 \quad (6)$$

or

$$S < 0 \rightarrow \dot{S} > 0 \rightarrow k\left(\dot{Vo} - \dot{Vref}\right) + \left(\ddot{Vo} - \ddot{Vref}\right) > 0 \quad (7)$$

C. *Implementation and Simulation Controller SMC on Buck Boost Single Phase Inverter with Buffer Inductor*

The difference of the system Inverter Buck Boost One phase with Buffer Inductor with the controller and the system without a controller is a system designed to be closed loop so that the required two additional elements that is the controller (SMC) and voltage sensors.

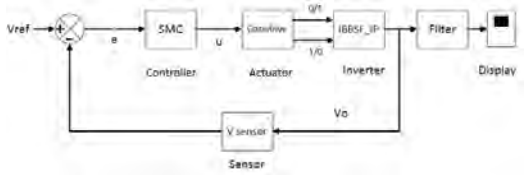

Figure 3. Block diagram of the control system.

RESULTS AND DISCUSSION

A control system is categorized robust if : (1) low sensitivity, (2) stable despite the change parameter variations, (3) the performance of the system remains in the criteria set although there are changes system parameters. Robustness of the system is also beginning to be used by many people [5].

1. *The open loop response of Inverter Buck Boost One Phase with Buffer Inductor*

Open Loop response testing performed in MatLab Simulink R 2009 A. Responses were obtained as shown in Figure 4.

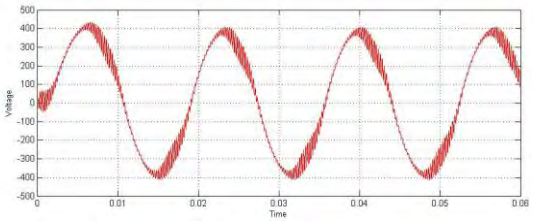

Figure 4. Response Voltage Open Loop using MatLab R2009A; Modulation Ratio = 0.8.

In the Open Loop Response testing, it was found that the value of the output voltage amplitude of 380 volts with an overshoot initial wave reaches 420 volts.

2. The Closed Loop Response of Inverter Buck Boost One Phase with Buffer Inductor Using SMC

Tests conducted with the software Matlab Simulink R2009A, by varying the amplitude set point value (SP) is 36 volts, 120 volts, 240 volts, 311 volts, 400 volts. Error Steady State (Ess) smallest setpoint is on 311 volts with a 1.02% and largest Ess there on setpoint 36 volts that is equal to 23.61%. The smallest overshoot values occurred at setpoint 36 volts at 47.5 volts and overshoot values occurred at 240 volts with a value setpoint 277.4 volts.

CONCLUSION

Overshoot occurs mainly due to the use of lowpass filter allows the frequency signal with a frequency lower than the cutoff frequency of the filter still escapes. Error steady state occurs because of possible impairment on the signal magnitude and because the filter cut off frequency that is used only a passive lowpass filter so it can not adjust the value of the gain of the output voltage to meet the setpoint. The main advantages from the use of SMC in this test method is that it can eliminate ripple that occurs during open-loop test.

In the test system sensitivity by varying the input voltage value and the resistance value resulting conclusion that the greater change in both parameters of the reference value, the sensitivity will be smaller, with the smallest 0,29 sensitivity value when the input voltage changes by 32%.

REFERENCES

[1] Darwito, Purwadi Agus, Soebagio and Purnomo, Mauridy Heri. *A New Topology Of Three Phase Buck-Boost Inverter With Buffer Inductor.* Institut Teknologi Sepuluh Nopember, Surabaya : JATIT &LLS, 2013, Vol. 51.

[2] Koushki B., Khalilinia H., Ghaisari J., Saghaian N.M. *A New Three-Phase Boost Inverter : Topology And Controller*, CCECE/CCGEI May 5-7 2008 Niagara Falls, Canada, 2008.

[3] Shittesel, Y**.** *Sliding Mode Control and Observation.* New York : Springer Science+Bussines, 2013.

[4] Tan, Siew-Chong, Lai, Yuk Ming and Tse, Chi Kong. *Sliding Mode Control of Switching Power Converters.* s.l. : CRC Press, 2012.

[5] Wicaksono, Handy. *Analisa Performansi dan Robustness ,Beberapa Metode Tuning Kontroler PID pada Motor DC.* Fakultas Teknologi Industri, Jurusan Teknik Elektro, Universitas Kristen Petra. Jurnal Teknik Elektro Vol. 4, No. 2, September 2004: 70 – 78.

Calculation Method to Analize The Concordance Between Supply and Demand of Bus Public Transport For Morning Commuter Trip at Gubeng Station

Jos Oktarina Pratiwi[1], Hitapriya Suprayitno[1]

Abstract - Surabaya is the center of activity for the province of East Java and eastern Indonesia. Commuting to Surabaya is very high. Thus, the concordance between supply and demand of public transport for commuter trip must be evaluated. For this purpose a calculation method has to be developed. The research objective has been achieved. The method calculation based on special matrix technics for overlay calculation.

Term Index - public transport, MAT origin destination, overlay, concordance.

INTRODUCTION

The city has an important role and function in the economy and regional development, bot regionally and internationally [1] [2]. Surabaya developed into a city trade and service, this requires the availability of the ease and speed of access, especially for transportation infrastructure. Surabaya as a business destination.

Commuting to the Surabaya is very higt with different travel destinations. In fact, on the main road that connects with hinterland is always crowded in the morning for trip to Surabaya and afternoon for trip out Surabaya.

Urban trafic transport has a role and an important function as facilities to support the implementation of the relationship and interaction between parts of the mobility of residents of the town [3] [4]. This networt integration to promote the establishment of increased production and productivity of the population in various activities [5] [6].

Mass transit such as trains is one alternative that connects trip to Surabaya. To reach the destination followed by public transport. But between the demand and supply of public transport routes need to know for concordance. This study assesses the concordance of the demand and suplyof public transport route by looking at the original matrix trip destinations, the provision of the existing public transports routes, demand for publict transport service, and assessment concordance between the demand and supply of public transport routes.

METHOD

Preparation phase for method is carried about this :

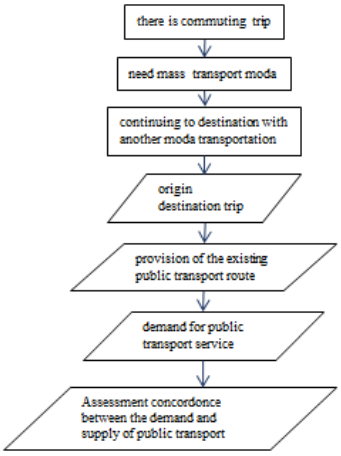

Figure 1. Preparation phase.

A. *Special Matrix Analysis [7] [8]*

Table 1. Basic form matrix.

m.B	1	2	3	4	5
1	m11	m12	...	...	m15
2	m21	m22	...	...	m25
3	...	...	...	...	...
4	...	...	...	...	...
5	m51	...	...	...	m55

Sumber: Suprayitno, 2014

B. *Overlay Analysis*

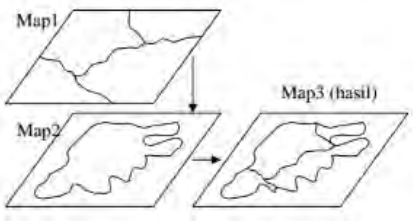

Figure 2. Overlay Analysis.

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RESULT AND DISCUSSION

C. *Origin Destination Matrix*

Figure 3. Ilustration Trip Distribution.

Tabel 2. Origin Destination Matrix.

Sampel MAT	1	2	3	4	5	6	TP i	
1	0	4	20	11	14	30	79	
TA i	0	4	20	11	14	30	79	79
		5%	25%	14%	18%	38%	1	

D. *Provision Of The Existing Public Transports Routes*

Figure 4. Ilustration Route Public Transport.

E. *Demand for Publict Transport Service*

Table 3. Matrix trip no need to served by AUT.

MAT tdk perlu dilayani AUT	1	2	3	4	5	6	TP i
1	0	4	0	0	0	0	4
TA i	0	4	0	0	0	0	4
perjalanan yg tidak perlu dilayani AUT		5%					

Table 4. Matrik trip need to served by AUT.

MAT perlu dilayani AUT	1	2	3	4	5	6	TP i
1	0	0	20	11	14	30	75
TA i	0	0	20	11	14	30	75
perjalanan yg perlu dilayani AUT			25%	14%	18%	38%	

F. *Assessment concordance between the demand and supply*

Figure 5. Ilustration The Corcordance.

CONCLUSSION

The research objective has been successfully fulfilles. The most important thing is that a calculation method which can be executed by using spread-sheet type program has been developoed. The advantage of spread-sheet can be utilized in maximum by creating special matrix calculation.

REFERENCES

[1] Adisasmita, Raharjo. *Mananjemen Transportasi Darat.* Yogyakarta: Graha Ilmu, 2011.

[2] Sadyohutomo, Mulyono. *Manajemen Kota dan Wilayah.* Jakarta: Bumi AKsara, 2008.

[3] Adisasmita, Sakti Adji. *Jaringan Transportasi.* Yogyakarta: Graha Ilmu, 2011.

[4] Miro, Fidel. *Pengantar Sistem Transportasi.* Jakarta: Erlangga, 2012.

[5] Nasution, Nur. *Manajemen Transportasi.* Jakarta: Penerbit Ghalia Indonesia, 2004

[6] Tamin, Ofyar. *Perencanaan dan Permodelan Transportasi.* Bandung: ITB, 2000.

ExtendedAbstract:Managing Risk of Lean Manufacturing Concept Implementation Approaching by Delphi and HOR

Wiwin Widiasih[1], Putu Dana Karningsih[1], and Udisubakti Ciptomulyono[1]

Abstract-The implementation of Lean Manufacturing (LM) concept was first performed at automotive industries. It is not easy being lean. Lean manufacturing concept implementation will not succeed at the first time. There were things that may have prevented the implementation meeting the objective is considered as risk. It necessary to maintain the risk of LM concept. This research will show the way for managing risk of LM implementation by Delphi and House of Risk method. This research was team up with aerospace industry in Indonesia who has been implementing LM concept. In this research, 19 risks have been identified. The rank of risk agent has been determined.

Index Terms - Risk, lean manufacturing implementation, delphi, house of risk.

INTRODUCTION

The implementation of Lean Manufacturing (LM) concept was first performed at automotive industries such as Toyota. The LM concept was able to adapted in many areas or industries including aerospace industry [1]. Because of LM concept has succeed implement at automotive industries, but there were many assumptions take into account when the LM concept has been implementing in another areas or industries especially aerospace industry.

It is not easy being lean [2]. LM concept implementation will not succeed at the first time. There were many fail to be learned when the company implement LM concept in its very first time such as lack of management commitment, lack of autonomy's team, no transparancy from management to socialize the objective's LM implementation, no mechanism for LM implementation, lack of communication, no evaluation and improvement plan be sustain [2].

The lean manufacturing concept implementation in this aerospace industry is done through projects or programs which have not yet meet the objectives. The thing that may have prevented the program meeting the objective has considered as risk. It necessary to prevent the potential risk occur. The main purpose of this research is how managing the risk of LM concept implementation with several methods.

DEVELOPMENT OF RISK MANAGEMENT

Risk can be defined as a disadvantage or loss of project's profit [3]. It necessary to maintain the potential risk. There was risk management which is concern to maintain the potential risk. Risk Management framework based on ISO 31000:2009 provides the generic model. In that general model consists of several phases such as context determination, risk assessment, risk mitigation, communication and consultation, also monitoring and review [4].

Several risks can be occured when LM concept was implementing such as people demotivated after a few years implementing LM concept, lack of LM knowledge, lack of communication, etc [5]. Those of risk of LM concept implementing had been identified by collecting some literature study.

There were many methods can be used to identify the potential risk. Risk identification can be figured out by depth interview, brainstorming, questionnaire, historical document, judgment based on experience, and direct observation. Then, it necessary to identify the risks analytically by expert. Delphi method is utilized to gather the potential risk from expert. Delphi method is a way of obtaining a collective view from individuals about issues where there is no or little definite evidence and where opinion is important. It is an iterative questionnaire exercise with controlled feedback to a group of panellist who are anynomous [6].

Risk identification also need to define whether risk agent or risk event. There is one method namely by House of Risk (HOR) which is combined from two model both failure mode and effect analysis (FMEA) and house of quality (HOQ) [7]. HOR is divided into two model, HOR 1 and HOR 2. HOR 1 has functioned to rank the risk agent based on their aggregate risk potential (ARP). ARP was calculated with formula below.

$$ARP_j = O_j \sum_i S_i R_{ij} \quad (1)$$

HOR 2 has funtioned to prioritize the proactive actions that the company should pursue to maximize the cost-effectiveness of the effort in dealing with the selected

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risk agents in HOR 1. In this research, only use HOR 1 in order to know the prioritize of risk agent.

RESEARCH METHODOLOGY AND RESULT

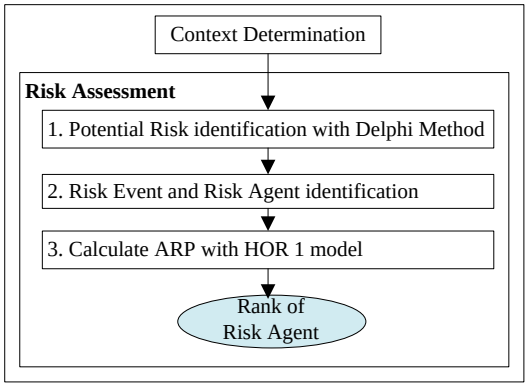

Figure 1. Research Methodology.

I. Context Determination

This phase will determine the scope of doing this research. The object of this research is in an Indonesian aerospace industry who has implemented LM for several years. The company was implementing LM concept as pilot project in several division.

II. Risk Assessment

This phase will conducted by risk identification, risk analysis, and risk evaluation. Risk identification has figured out with Delphi method. The Delphi method consists of several steps. First, determine the team who monitor and responsible the Delphi process, in this research that is not only manager Lean & Development Department but also the researcher. Second, select responden that is consists of manager and head of division in Production Directorate. Third, explain the objective of Delphi process that is to identify potential risk of LM implementation. Fourth, establish questionnaire each round. Fifth, establish resume result each round. In this research conduct by three rounds and there had been consensus. Table 1 shows partial list of 19 risks have been identified and classified whether risk events or risk agents. There were 10 risk events and 9 risk agents.

TABLE 1. PARTIAL LIST OF RISK LEAN IMPLEMENTATION.

Code	Risk Events	Code	Risk Agents
E1	action plan couldn't be finished on time	A1	lack of consistent and commitment top management
E2	demotivated employee	A2	lack of supporting facilities
E3	employee did not feel responsible with lean	A3	lack of lean manufacturing implementation knowledge
...	...	...	...
E10	lean training material was not delivered well	A9	difficult to change work culture

ARP was calculated by equation 1. O_j is the probability of occurrence of risk agent j, S_i is the severity of impact if risk event occured, and R_{ij} is the correlation between risk agent j and risk event i that is scale 0, 1, 3, 9 refers to no, low, medium, and high correlation.

In this research, the top rank of risk agent has to be prioritized is code A4 refers to lack of communication and socialize from management to employee with ARP value 824. Then, code A3 refers to lack of lean manufacturing implementation knowledge and tools with value 604 and code A5 refers to lack of human resources qualification with value 556.

REFERENCES

[1] Crute, V., Ward., Y., Brown, S., dan Graves, A., "Implementing Lean in aerospace-challenging the assumptions and understanding the challenges", *Journal of Technovation* (23), 2003, pp. 917-928.

[2] Rathje, Maike Scherrer., Boyle, Todd A., Deflorin, Patricia, "Lean, take two! Reflections From The Second Attempt At Lean Implementation", *Journal of Business Horizons* (52), 2009, pp. 79-88.

[3] Ahmed, Ammar., Kayis, Berman., dan Amornsawadwatama, Sataporn., "A Review of Techniques for Risk Management in Projects", *Benchmarking: An International Journal*, *Volume14 Number* 1, 2007, pp. 22-36.

[4] Susilo, Leo J., "Manajemen Risiko Berbasis ISO 31000 untuk Industri Nonperbankan", PPM: Jakarta Pusat, 2015.

[5] Marodin, Giuliano Almeida dan Saurin, Tarcisio Abreu, "Classification and Relationships Between Risks That Affect Lean Production Implementation: A Study In Southern Brazil", *Journal of Manufacturing Technology Management*, *Volume* 25 *Number* 1, 2014, pp. 57-79.

[6] Thanaratinam, Shakila., Redman, WE Charler., "The Delphi Technique", *Education The Obstetrician & Gynaecologist*, 2005, pp. 120-125.

[7] Pujawan dan Geraldin, Laudine H, "House of Risk: A Model for Proactive Supply Chain Risk Management", *Business Process Management Journal*, *Volume* 15 *Number* 6, 2009, pp. 953-967.

The Significant of Cobit Mapping Business Goal 12 and IT Goal 19 (Case Study: Stikom Surabaya)

Siti Mukaromah[1] and Apol Pribadi Subriadi[1]

Abstract - IT Governance is a branch of the corporate governance system focused on information technology (IT) as well as performance and risk management. IT Governance is defined as the processes that ensure the effective and efficient use of IT in enabling an organization to achieve its goal. There are many different frameworks that can be used for managing the delivery of cost-effective IT services. IT managing the delivery of cost-effective IT services does not always give the advantage to the company. There are times when the IT managing the delivery of cost-effective IT services does not provide any benefit, it can cause IT Productivity Paradox. IT Productivity Paradox can be prevented, one is to analyze the processes undertaken with IT. From this analysis we will get the significance of the relationship processes with the IT Goal. The significance will be seen which one significant process and which one are not significant to the IT Goal. If the IT process there are not significant to the IT Goal, the process does not need to be repaired because it has no effect on IT Goal. Existing IT governance frameworks are COBIT, ITIL, ISO 20000, 17799/27001, Six Sigma, etc. The IT Infrastructure Library (ITIL), initially developed in the UK by the Office of Government Commerce (OGC), is gaining traction in the global IT community as a framework for IT governance. ISO 20000-focusing upon IT service management. ISO 17799 / ISO 27001 - focusing upon information. Six Sigma-focusing upon operational performance and defect identification. COBIT - framework for information IT management risks. Control Objectives for Information and related Technology (COBIT) provides good practices across a domain and process framework and presents activities in a manageable and logical structure. COBIT's good practices represent the consensus of experts. They are strongly focused more on control, less on execution. These practices will help optimise IT-enabled investments, ensure service delivery and provide a measure against which to judge when things do go wrong. This research is intend to find out whether Cobit mapping Business Goal to IT Goal appropriate with case study. The result The results using SEM approach shows that the mapping of COBIT is not significant in the case studies of academic administration.

Index Terms - Business Goal, Cobit, IT Goal, IT Productivity Paradox, SEM, significant.

INTRODUCTION

For couple years IT alignment was the interesting topic to be discussed and deliver some new findings. Henderson and Venkatraman was propose IT alignment with proposition and management implications.

The reason why business and IT align to be discussed is how IT impact to organizations business. The alignment is not always give such a good impact for the organizations. When IT doesn't give positive impact for the organizations, it can cause IT Productivity Paradox [1].

When carrying out operation of the organizations, it needs management guideline. IT governance framework need to be implemented. Control Objective for Information and Related Technology (COBIT) can be used as tool that use to streamline the IT Governance implementation. [3]

METODOLOGY

COBIT

ISACA (Information System Audit and Control Association) introducing a framework for managing IT Governance in a company known as COBIT. COBIT can provide a set of acceptable practice in general because it can help the directors, executives and managers increase the value of IT and reduce risk. [3]

PRODUCTIVITY PARADOX

Brynjolfsson [4] on their research Information Technology and Productivity: A Review of the Literature, said that the relationship between information technology (IT) and productivity has been the source of debate.

At The New York Times Book Review on July 12, 1987 article Robert Solow give a discourse entitled We'd better watch out raises stigma that the implementation of computer technology sometimes does not give a positive influence on the company. A sentence that makes being contradictory is "You can see the computer age everywhere but in the productivity statistics".

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IT ALIGNMENT

IT Alignment Model is a good framework for comparing, analyzing the IT department objectives, targets and activities for the purpose, objectives and activities of the company. [4]

STRUCTURAL EQUATION MODELING (SEM)

Structural Equation Modelling (SEM) is a structural equation model is a combination of the procedures developed in econometrics [5]. SEM is used to examine and justify a model and to explain the relationship between variables that exist.

GENERALIZED STRUCTURED COMPONENT ANALYSIS (GSCA)

Generalized Structured Component Analysis (GSCA) a method for SEM created by Hwang and Takane. So it can be said that GSCA is part of the SEM-based components that have global criteria least square optimization. GSCA is equipped with the size of the model goodness of fit. GSCA was developed to avoid the shortage of Partial Least Square (PLS) is to complement global optimization procedures, and also maintains a local optimization procedure.

GSCA is a new method of SEM-based components that can be used to perform calculations scores and also can be applied to a small sample. [6]

HYPOTHESIS

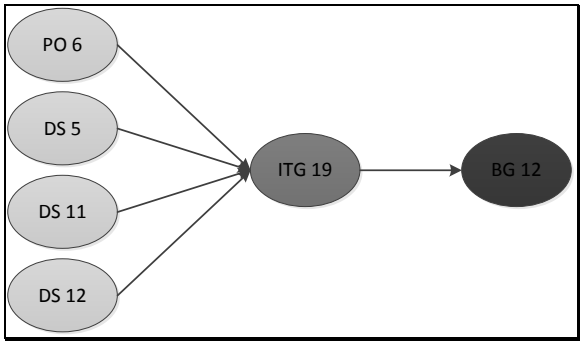

Figure 1. Cobit mapping Business goal 19 and it goal 19 and its it processes.

H1 = IT process PO6 positively related to achievement IT Goal 19.
H2 = IT process DS5 positively related to achievement IT Goal 19.
H3 = IT process DS11 positively related to achievement IT Goal 19.
H4 = IT process DS12 positively related to achievement IT Goal 19.
H5 = IT Goal 19 positively related to achievement Business Goal 12.

REFERENCES

[1] Brynjolfsson, Erik. (1993). The productivity paradox of information technology. Communications of the ACM. Volume 36 (12), page 66–77.

[2] Brynjolfsson, E dan Yang, S. (1996). Information Technology and Productivity: A Review of the Literature. Elsevier. Volume 43. Pages 179–214.

[3] ITGI. 2007. COBIT 4.1: Control Objective, Management Guidelines, Maturity Models. United States of America: IT Governance Institute.

[4] Henderson. J. dan Venkatraman. N. (1992). Strategic Alignment: A model for organisational transformation through information technology. T. Kochan & M. Unseem, eds, Transforming Organisations, Oxford University Press, NY.

[5] Wijayanto, S. H. (2008). Structure Equation Modelling, Konsep dan Tutorial Dengan Lisrel 8.80. Jakarta: Graha Ilmu.

[6] Tenenhaus, M. (2008). Structural Equation Modelling for small samples. Working paper no 885.

Method for Assessing Implementation of Design Build Project Delivery System in Indonesian Road Infrastructure Projects (Cases Study : Balai Besar Pelaksanaan Jalan Nasional V)

Ashri Maharani[1], Hitapriya Suprayitno[1], Herry Budianto[2]

Abstract - Public infrastructure, particularly road infrastructure, has a strong linkage with the economic growth of a nation. Management of road infrastructure by the DG of Highways-Ministry for PW is currently implemented by using traditional methods of DBB contract system. Although DBB approach is considered more fair for the contractor, it may not be able to create more value for the Government. Long periods of procurement, often result in undesirable outcomes such as excessive cost, unsatisfactory quality and delays in implementation time. The DB project delivery system is expected to answer the above problem and therefore, there is a need to examine how to assess the feasibility of DB Contract implementation for road infrastructure projects under the authority of BBPJN V. This paper present the method assessment development

Term Index - Design and build (DB) project delivery system, implementation potential obstacles, supporting factors, road infrastructure projects under the authority of BBPJN V.

INTRODUCTION

Public infrastructure, especially roads, has a strong links with the economic growth of a nation. Handling of road infrastructure by the DG of Highways, Ministry of PW is currently implemented using traditional methods DBB Contract System[4].

On behalf of the Government of Indonesia, the Directorate General of Highways, Ministry of PW and PH has the authority for the provision of road infrastructure. In order to carry out its functions effectively, the Ministry of PW is mandated to adopt DB Contract System [1]. In fact, the DB contract system implemented in the Law Decree No. 18/1999 [5]. In addition, PP RI No. 29/2000 on the Implementation of Construction Services Article 13 paragraph 1, 2, 3 and 4 [3].Therefore DB Contract System need to be investigated.

METHOD

Method of assessing the feasibility of implementing the contract will use in this research. The first thing to do is a good understanding of the phenomenon of contract which, in order to determine the second step. The second step of determining feasibility requirements in the form of implementation contract.Without a good understanding of the phenomenon of contract, eligibility status could not be formulated properly. After the formulation of the eligibility requirements, followed by action to formulate component of the eligibility criteria, which is a derivative of eligibility requirements. After that then the fourth most difficult step is to design the measurement method to measure the feasibility of eligibility requirements that have been formulated in the second step [2].

The steps method of preparing the concept as assessment methods can be illustrated in the following flowchart at Figure 1. [2]

FIGURE 1. METHODS FLOWCHART OF PREPARING THE CONCEPT AS ASSESSMENT METHODS

Figure 1. Method flowchart of preparing the concept as assessment methods

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RESULT AND DISCUSSION

The result flowchart were shown in the figure 2.

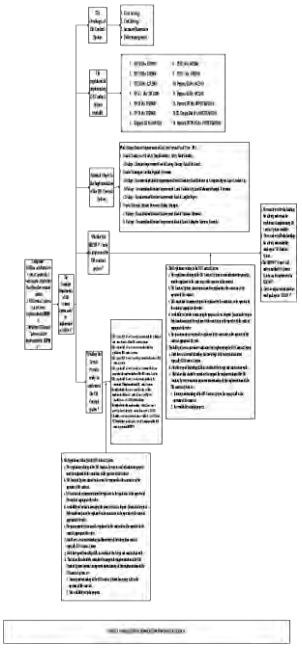

Figure 2. Variable operational definition.

The questions in the study variables still been copied-described can be follow-up questions to be drawn a conclusion perception / opinion of the respondents.

Preliminary survey was conducted to determine the response of respondents to the questions that exist in the questionnaire and to identify the advantages DB Contract System, the readiness of the service users and service providers in implementing the DB contract system in the management of road infrastructure in some streets under the authority BBPJN V, DG of Highways, Ministry of PW and PH. Preliminary surveys conducted by questionnaire open models in which the respondent can increase or decrease the variable. The survey results are used to assign the variables as well as the preparation of the next questioner.

CONCLUSION

Research objectives has been achieved. Method for assessing DB Contract implementation has been successfully developed. The feasibility requirement consists of 5 elements. The first three, answered by the researcher, indicated that the DB Contract Implementation is feasible. Measurement instruments, in a form of a set of questionaire, for interviews with the experst have been designed and has been tested.

The DB contract delivery system project is predicted to be relatively simple and easy to be implemented in accordance with the appropriate capabilities level of service user and service providers.

REFERENCES

[1] Departemen Pekerjaan Umum. *"Bina Marga Akan Terapkan Kontrak Design & Build Proyek Jalan dan Jembatan."*. 2009.

[2] H. Suprayitno et al. "Konsep Dasar Metoda Pengukuran Kelayakan Penerapan Sistem Kontrak Baru". *Prosiding Seminar Nasional Manajemen Teknologi XXIII.* Program MMT – ITS. 2015

[3] Peraturan Pemerintah Republik Indonesia Nomor 29 Tahun 2000 tentang Penyelenggaraan Jasa Konstruksi.

[4] H. Rahadian, *Langkah Awal Menuju Performanced Based Contract Melalui Extended Warranty Period*. 2009.

[5] Undang-undang Republik Indonesia Nomor 18 Tahun 1999 tentang Jasa Konstruksi. 1999.

Business Process Anomaly Detection using Multi-Level Class Association Rule Learning

Fernandes Sinaga[1], Riyanarto Sarno[1]

Abstract - Recently, Business Process Management System (BPMS) is widely used by companies in order to manage their business process. The company's business process has a possibility to have changes which can cause some variations of business process. These variations might be contain some anomalies. Any anomalies that can make some losses for the company can be regarded as a fraud. There were some research have done to detect anomalies in business process. But, there is some issues that still need improvement especially on the accuracy. This paper proposed Multi-Level Class Association Rule Learning method (ML-CARL) to detect business process anomalies accurately. This method is supported by the process mining method which is used to analyze the anomalies in process. From the experiment, ML-CARL method can detect anomalies with an accuracy of 0.99 and better than ARL method in previous research. It can be concluded that ML-CARL method can increase the accuracy of business process anomaly detection.

Term Index - Business process, Anomaly detection, Process mining, Multi-level class association rule learning

INTRODUCTION

Some companies in the world have used the business process management system such as BPMS, Enterprise Resource Planning, etc. The goal is to control and manage their business process. Company's business process can be changed along with the market, the requirement changes, and the policy changes. These changes can make some variations of business process. There is a possibility that there are anomalies in those process variations [1]. These anomalies can cause some losses for the company so it can be regarded as fraud. [2]. Fraud is done without consider to the goal and the principles of the company.

Fraud is a widespread problem in the world. In 96 countries, there are 1,388 fraud caused losses of up to 1,4 billion US Dollars. [3]. Fraud could happen because of anomalies to business process standard and data manipulation [4]. Fraud could be defined as crimes that use deception as a major modus operandi and include various aberrations by individuals or organizations [5]. In order to reduce the losses, fraud detection techniques are needed.

In computer science, there were two analysis techniques have been done to detect fraud, namely data mining and process mining. *Decision Tree, Neural* and *Bayesian Network,* and *Support Vector Machine* were examples of data mining technique which had done by the previous research to detect fraud in process [6], [7], and [8]. However, these methods have limitations in detecting anomalies because these methods were not able to analyze the behavior of process control flow. Furthermore, process mining could detect anomaly in process with conformance checking. Conformance checking is not only a process mining technique that compare the actual process data and the standard process model but also could analyze the process control. In the context of fraud detection, any anomalous parts were considered as a compromising fraud [2].

Other researches which support the fraud detection was using Association Rule Learning (ARL). There were two research which had used ARL. First, research of fraud detection which applied to credit card application in the retail company in Chile [9]. This research focused on mining data in the form of association rules to detect fraud. The second research was fraud detection on business process of credit application [10]. This research had combined process mining and ARL so they could detect fraud with an accuracy of 0,865. But, there were still a high value of false positive and false negative.

This paper will propose a Multi-Level Class Association Rule Learning (ML-CARL) method to detect fraud accurately. The main goal is to reduce the number of the false positive and false negative in order to increase the accuracy. This method is used because of two reason. First, multi-level association analysis is used to find the hidden information in or between levels of abstraction. Second, classification association rule is used to find association rules efficiently according with user's need. So, the goal of this method is to gain more knowledge from the anomalies data in order to produce association rules effectively and efficiently. This method is supported by conformance checking technique to analyze anomalies in the process and fuzzy multi attribute decision making to calculate the rating of fraud for each process.

Concordance. This study assesses the concordance of the demand and suplyof public transport route by looking at the original matrix trip destinations, the provision of the existing public transports routes, demand for publict transport service, and assessment concordance between the demand and supply of public transport routes.

METHOD

We are analyzing business process of a credit application in bank with process mining to detect any anomalies in the process. Then, we use fuzzy multi-attribute decision making to calculate fraud's rate of each case (instance process). And finally, we mining the association rules of anomaly from the anomalies data correspond to their fraud's rate using Multi-Level Class Association Rule Learning (ML-CARL).

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In ML-CARL, there are two steps to mining the rules. First, classify the cases into some classes which were defined. There are three classes, Non-Fraud class, Semi Fraud Class and Fraud Class. We classify using a fuzzy membership function. We use the fraud's rate of each case as a parameter for the classification. And the second step is mining rules using multi-level association rule. From this ML-ARL method, we generate some association rules which could represent anomalies in process effectively.

EXPERIMENTAL DESIGN

The evaluation in this research focuses on measuring the accuracy of the ML-CARL methods. The experiment has done to a case study of business process in bank credit application. The variable in dataset is consisted of cases or transactions, and 10 anomalies attributes. The dataset is divided into training dataset and testing dataset which generated by two distribution models like in [10]. The first distribution model is Poisson distribution. We use this model to generate the number of cases of anomaly of each attributes randomly. And the second distribution model is uniform (discrete) distribution. We use this model to spread over the anomalies in 50 cases each month randomly and based on the number of anomaly occurrences for each attribute.

We generate 1200 cases were divided into training data and testing data. There are 1000 cases for training data while testing data has 200 cases. In training data, there are 20 cases of fraud, 14 cases of semi fraud and 966 cases of non-fraud. In testing data, there are 5 cases of fraud, 3 cases of semi fraud and 192 cases of non-fraud

EXPERIMENTAL RESULT AND DISCUSSION

From the training using ML-CARL, we generates 24 association rules. Then, we test the testing data using this 24 rules. We get a True Positive/Fraud (TP) value of 5, a False Positive/Fraud (FP) value of 0, True Semi Positive / Semi Fraud (TSP) value of 2, False Semi Positive / Semi Fraud (FSP) value of 1, True Negative / Non-fraud (TN) value of 191 and False Negative / Non-Fraud (FN) value of 1. Then, we use the accuracy measurement to test the performance of this method. The accuracy of this ML-CARL method is 0.99. This accuracy is better than the accuracy of ARL method in previous research [10].

CONCLUSION

From the experiment, we can conclude that the ML-CARL method can detect anomalies in business process well and accurately. This is caused by the generated association rules can describe anomalies in business process effectively and efficiently. Furthermore, conformance checking can help in analyzing the anomalies in the process. So, the combination of the ML-CARL method and the conformance checking analysis can increase the accuracy of business process anomaly detection.

REFERENCES

[1] R. Sarno, A.B. Sanjoyo, I. Mukhlash and H.M. Astuti, "Petri Net Model of ERP Business Process Variations for Small and Medium Enterprises," Journal of Theoretical and Applied Information Technology, vol. 54 No.1, August 2013, pp. 31-38.

[2] J. Stoop, "A case study on the theoretical and practical value of using process mining for the detection of fraudulent behavior in the procurement process," in Process Mining and Fraud Detection, Netherlands, Twente University, 2012, pp. 22-63.

[3] "Report to the Nations on Occupational Fraud and Abuse," ACFE, 2014, p.19.

[4] M. Jans, N. Lybaert, K. Vanhoof, and J. M. van der Werf, "A business process mining application for internal transaction fraud mitigation," Expert Systems with Applications, vol. 38, 2011, pp. 13351-13359.

[5] Wells, J.T. Occupational Fraud and Abuse. Dexter, MI: Obsidian., 1997, p.221.

[6] F. Ogwueleka, Data Mining Application in Credit Card Fraud Detection System, Nigeria: Department of Computer Science, University of Abuja, 2011, pp.311-322

[7] Ngai, E.W.T.,Yong Hu, Wong, Y.H., Chen Y.,Sun, X, "The application of data mining techniques in financial fraud detection: A classification framework and an academic review of literature," Decision Support Systems, vol. 50, 2011, pp. 559-569.

[8] Bhattacharyya, S., Sanjeev J., Tharakunnel, K., Westland, J.C, "Data mining for credit card fraud: A comparative study," Decision Support Systems, vol. 50, 2011, pp. 602-613.

[9] D. Sanchez, M. Vila, L. Cerda, and J. Serrano, "Association rules applied to credit card fraud detection," Expert Systems with Applications, pp. 3630–3640, 2009.

[10] R. Sarno, R. D. Dewandono, T. Ahmad, M. F. Naufal and F. Sinaga, Hybrid Association Rule Learning and Process Mining for Fraud Detection, IAENG International Journal of Computer Science, 2015, pp. 59-72

Performance Improvement of Business Process Similarity Calculation using Word Sense Disambiguation

Endang Wahyu Pamungkas[1], Riyanarto Sarno[1], Abdul Munif[1]

Abstract - Similarity calculation between Business Process Models (BPM) has an important role in the process of managing BPM repository. One of its uses is to facilitate the searching process of a model in the repository. Similarity calculation between business processes is closely related with semantic string similarity. Semantic string similarity is usually performed by utilizing a lexical database, such as WordNet, to find the semantic meaning of words. The problem in WordNet is that this lexical database contains terms wich have more than one meaning or polysemous. Selecting the wrong meaning will decrease the accuracy of similarity calculation process. In this study, we will try to improve the accuracy of similarity calculation of business processes using Word Sense Disambiguation (WSD). The main purpose is to eliminate the ambiguity of polysemous words before calculating the similarity value. WSD is performed by unsupervised methods based on the value of graph connectivity. Then, we used a lexical database that is focused in the business and industry field. The results from this study is able to achieve higher accuracy of the sense selection process for terms especially terms that are related to business and industrial domains. It will also increase the accuracy of similarity value calculation between the business process models.

Term Index - Word Sense Disambiguation, string semantic similarity, business process model similarity.

INTRODUCTION

Semantic string similarity has many applications and benefits for business process management. Generally, the semantic similarity of a text is often used to find the value of the similarity between words. Classification of documents as well as data retrieval are few of well-known technique that also utilizing this method. In business process management, This method also used in the process of clustering business process model. The semantic string similarity algorithm is used to calculate the value of similarity between activities in business process model [1]. Besides that, this technique is also used in the process of business process discovery [2]. In the discovery process, semantic aspects is used to obtain models that have similar function but with different syntax as keyword. So, user can obtain models using keywords without have to use the exact same syntax as the model notation [3].

There is a tool developed by Princeton University that already well-known and widely used to find similarity value between texts, called WordNet. However, the use of WordNet for words that are related to business processes is still facing many problem. Although it is constructed in the form of graph, this lexical database is still not able to handle the ambiguity of words. This case usually occurs in polysemous words. For example, the word "call" can be define as "command to come" or "a telephone connection". Moreover, it has 30 gloss with different meaning in WordNet. Hence, the topic of word sense disambiguation is still a concern in the field of natural language processing. This will also affect the accuracy of semantic string similarity calculation.

Based on these problems, this study presents a method to improve the accuracy of string similarity value calculation. The purpose is to eliminate the ambiguity of the word using WSD before we calculate the similarity value. WSD process will be implemented using unsupervised methods and utilized a dictionary. Selection of the correct meaning is determined by the value of connectivity graph that formed based on lexicon or dictionary. We use WordNet as dictionary and some vocabulary in business domain for addition. The results of this study are expected to improve the performance of semantic string similarity calculation and especially for the similarity between business process models.

METHOD

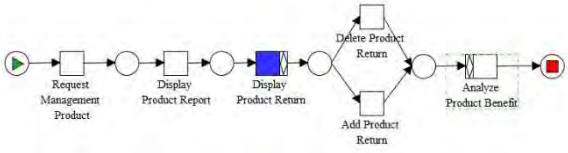

Figure 1. Business Process Model example 1.

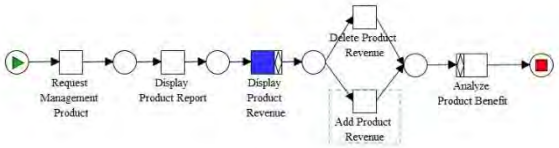

Figure 2. Business Process Model example 2

Business process similarity is highly correlated to string similarity. The label of every element in the model is compared in the process of calculating process business similarity. String similarity itself also has been developed to improve the accuracy of the comparison process. Semantic string similarity is one of the development. In semantic similarity, the similarity value is obtained not only by looking at the structure of the word but also from the meaning of the word. So, the calculation process itself requires the assistance of a lexical database. WordNet is a lexical

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database that often used to assist the calculation of semantic string similarity. Many methods have been developed to calculate the value of semantic similarity string such as Path Length, Leacock & Chodorov, and Wu Palmer. In general, these methods calculates the distance between words in WordNet and take the shortest distance as the selected meaning. The shortage is that these methods are not considering the context of words in a sentence. Thus, it is possible that the shortest distance is not necessarily the correct meaning.

Word Sense disambiguation is the process of eliminating ambiguity in the meaning of polysemous words. In this study, WSD is regarded as an essential step before calculating the value of the similarity between words. Word with the same syntax does not necessarily have the same meaning. We utilize WordNet lexicon to perform unsupervised method. The selection of word sense is determined from the inverse path length sum values [4] based on the graph structure that is formed. The graph itself is constructed from the traversal process within the structure of WordNet.

As an example, we compare the model in Figure 1 and Figure 2. We try to calculate the value of the semantic string similarity of the term "display product return" with the term "display product revenue" using the help of WordNet. Both of these terms have common initial words, "display" and "product". So, the similarity value of these words in semantic is 1. There is a difference in the last word, "return" and "revenue". By using Path Length the meaning of the word "return" is defined as "the income or profit arising from such transactions as the sale of land or other property" and the meaning of the word "revenue" is defined as "government income due to taxation". Hence without seeing the context of the word in the sentence, the similarity value is 0.25.

But, if we perform word sense disambiguation process in advance to get the meaning of a sentence based on the context, the word "return" is defined as "the income or profit arising from such transactions as the sale of land or other property" and the word "revenue" defined as "the entire amount of income before any deductions are made". The similarity value is 0.17. So that, we can conclude that the shortest distance is not necessarily provide the correct meaning of the word. We can conclude that WSD process is necessary to improve the accuracy of semantic string similarity calculation.

RESULT AND DISCUSSION

The results shows that the proposed method can achieve high accuracy even for the terms that are specific to business domain. The accuracy value is equal to 0.925. Only 9 terms from 120 terms is given the wrong sense. Therefore, we can conclude that the method is suitable to calculate the similarity value of business process implemented only one giving any sense for nine terms. Because the terms that are used for experiments is already represent the name of the business process activities.

Furthermore, we use real business process model as dataset. There are 32 business process models in Petri Net notation with a total of 69 different activities. We calculate semantic string similarity value for each activity and compare the result with Path Length method. As evaluation, we calculate accuracy value for the chosen sense. So that, we have to construct a gold standard which contains proper sense of the activities. Our proposed method can get 0.91 of accuracy. While path length method that also use WordNet get an accuracy of 0.88. So we can see that our proposed method is able to improve the semantic string similarity process and also similarity of business process. Even though, both method use WordNet as lexicon, our proposed method can give better accuracy.

CONCLUSION

The evaluation and the testing result shows that the proposed method has a good performance. Even for the terms in business domain that used in business process activities. The accuracy for SAP code dataset terms is 0.92. Besides, we also evaluate our method using dataset of real business process models. From the result, we can conclude that our proposed method can give better accuracy than Path Length method while choosing the correct sense. From these results we can concluded that the WSD method is very suitable to improve the performance of business process similarity value calculation. However, this research found some improvements that is important to be done. There are many terms in the field of business domain that have not been accommodated by WordNet. Thus, cause a decline in the accuracy of Word Sense disambiguation process. Therefore, at this time we also are currently developing a lexical data bases which specifically includes words within the business domain. Moreover, there is also a need to test another method for calculating graph connectivity because it is possible that there are other methods for calculating connectivity graph which have better accuracy.

REFERENCES

[1] R. Sarno, "Similarity of business process fragments," in *Computer, Control, Informatics, and Its Applications IC3INA*, 2013.

[2] R. Sarno, C. A. Djeni, I. Mukhlash and D. Sunaryono, "Developing A Workflow Management System for Enterprise Resource Planning," *Journal of Theoretical and Applied Information Technology,* vol. 72, no. 3, pp. 412-421, 2015.

[3] A. A. A. Polyvyanyy and M. Weske, "Semantic querying of business process models," in *Enterprise distributed object computing conference EDOC'08 12th International IEEE*, 2008.

[4] S. Brin and M. Page, "Anatomy of Large-Scale Hypertextual Web Search Engine," in *Proc. Seventh Conf. World Wide Web*, 1998.

Performance Test of Double Crossed Membrane Contactor for Simultaneous Absorption-Desorption Of CO_2 Using Diethanolamine

Yeni Rahmawati[1], Toto Iswanto[1], Muhammad Rifa'i[1]

Abstract – This study aimed to test the performance of polypropylene hollow fiber that were configured in the double crosses configuration as membrane contactor by combining absorption-desorption process simultaneously in one module using diethanolamine as solvent which is expected to separate CO_2 optimally by using of minimal solvents. The solvent allowed to stand in the shell module, feed gas supplied to the lumen of the first tube, and sweep gas flowed into the lumen of the second tube of membrane module. The experimental results showed that during the first three hours, the flux of absorption decreased until $2.63x10^{-5}$ mol/m^2.s and the efficiency of absorption decreased to 5.181%, whereas flux of desorption increased every hour until $6.202x10^{-5}$ mol/m^2.s during performance test, while the efficiency of desorption rose to 92.437%.

Index Terms – CO_2 separation, hollow fiber membrane contactor, polypropylene, simultaneous absorption-desorption.

INTRODUCTION

The research on membrane contactor using absorption-desorption process of CO_2 had most commonly done separately/hybrid, in which the absorption-desorption process by separate equipment requires a large enough circulation of solvent, so that when the use of expensive solvents will enhance the overall operational costs. Therefore, developed membrane contactors for absorption-desorption process of CO_2 simultaneously using a dual crosses of membrane contactor module.

The research on the crossed membrane contactor for absorption-desorption process of CO_2 simultaneously had done by Guha (1990), Kumazawa (2000), and Shimada (2006). However, these studies were still using small concentrations of CO_2 gas, which was 5-30% by volume, while the content of CO_2 gas in natural gas can reach 30-60% by volume such as in Natuna natural gas.

In this paper, the detailed study polypropylene hollow fiber that were configured in the double crosses configuration as membrane contactor by combining absorption-desorption process simultaneously in one module using DEA is reported. The concentration of CO_2 in sales gas and sweep gas out were investigated by Gas Chromatography (GC) analyzer. The flux and efficiency of absorption and desorption process of CO_2 were calculated by a formula.

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MATERIAL AND METHOD

A. Material

In the present paper, a polypropylene (PP) hollow fiber membrane contactor were used to capture CO_2 in the feed gas (40% of CO_2 balanced with N_2). Diethanolamine (DEA) 30% of mass was role as CO_2 absorber and N_2 gas, 99.95% balanced with O_2 was role as sweep gas. Those gas are from PT. Aneka Gas Industry. The PP hollow fiber membrane has specification as following:

Table 1. Specification of hollow fiber membrane module

Parameters	Value
Module inner diameter (mm)	0.35
Module outer diameter (mm)	0.5
Pore size (μm)	0.2
Membrane fiber length (mm)	83
Number of fibers	2500
Number of layer	25
Contact area gas-liquid (m^2)	21.195
Fiber Porosity	0.65

B. Experimental Apparatus and Procedures

1) Determining the Best Operating Parameters

To know the best operating parameters value of feed gas and sweep gas flow rate, so investigation of flux and efficiency of absorption and desorption were firstly determined.

The solvent, DEA 30% of mass, was pumped through the bottom of the membrane module using pump 1.6 LPM (Deng Yuan Industry co., ltd, Taiwan) until all of membrane completely submerged. Then, feed gas (mix gas 40% CO_2 balanced with N_2**)** was introduced into the system from compressed gas cylinders and its flow rate was adjusted by rotameter (Dwyer Instrument. Inc.) that was set 400-800 ml/minute according to experiment variables, so do the sweep gas.

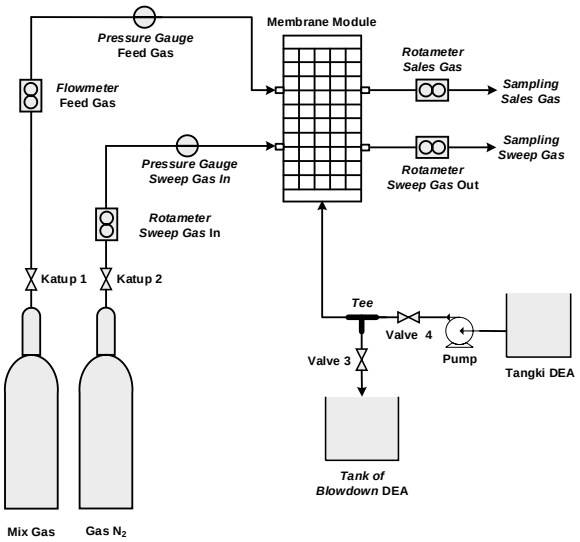

Figure 1. Schematic drawing of experimental setup

All data were collected at steady state, after at least 30 min of operating time. Steady state was indicated by constant CO_2 concentration in the outlet gas (sales and sweep gas) stream. All concentration of CO_2 had determined by GC analyzer. The value of absorption and desorption efficiency and mass transfer rate of CO_2 were calculated by equation (1) [1] and (2) [2] for absorption and equation (3) and (4) for desorption.

$$J_{CO_2(absorpsi)} = \frac{(Q_{in}\times C_{in} - Q_{out}\times C_{out}) \times 273{,}15}{0{,}0224\times T_g \times S} \quad (1)$$

$$\eta = \frac{Q_{in}\times C_{in} - Q_{out}\times C_{out}}{Q_{in}\times C_{in}} \times 100\% \quad (2)$$

$$J'_{CO_2} = \frac{(V_{out}\times K_{out}) \times 273{,}15}{0{,}0224\times T_g \times S} \quad (3)$$

$$\eta' = \frac{V_{out}\times K_{out}}{Q_{in}\times C_{in} - Q_{out}\times C_{out}} \times 100\% \quad (4)$$

From the maximum value of absorption and desorption efficiency and mass transfer rate of CO_2 in this part, flow rate 800 ml/min of mix gas and 400 ml/min of sweep gas were selected as the best of operating parameters value that will be used in long-term test performance of membrane module for 8 hours of operation time. Its procedures were almost same with procedure of determining the best operating parameter above. The differences were about their flowrate of mix and sweep gas.

RESULT

From Figure 2, it can be seen that the flux of desorption progressively increasing. This could be caused by solvents that became saturated with CO_2. The difference in CO_2 concentrations were large, the CO_2 in the solvent diffused into the sweep gas.

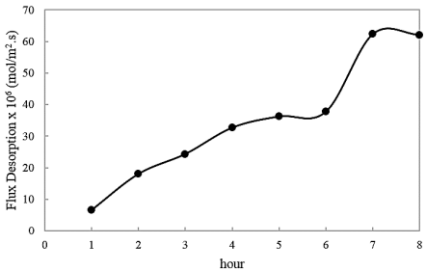

Figure 2. Flux of desorption for long-term performance of membrane contactor during 8 hours of operating time.

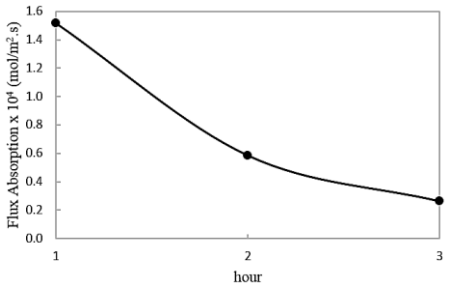

Figure 3. Flux of absorption for long-term performance of membrane contactor during 3 hours of operating time.

In the first three hours of the test performance, absorption flux progressively decreased, as shown in Figure 3. It could be caused by gas trapped in the membrane that was pushed out. CO_2 gas was trapped in the membrane indicates that the gas was not absorbed into the solvent. It could be caused by a solvent which began saturated or membrane surface that had been wet resulting membrane pores closed.

During the first three hours, the flux of absorption decreased until $2.63\text{x}10^{-5}$ mol/m^2.s and the efficiency of absorption decreased to 5.181%, whereas flux of desorption increased every hour until $6{,}202\text{x}10^{-5}$ mol/m^2.s during performance test, while the efficiency of desorption rose to 92.437%.

CONCLUSION

For overall, the membrane contactor was able to absorb and desorb CO_2 during the three-hour performance test.

REFERENCES

[1] Kumar, P.S., Hogendoorn, J.A., Feron, P.H.M., Versteeg, G.F. (2002). "New Absorption Liquids for the Removal of CO_2 from Dilute Gas Streams Using Membrane Contactor." *Journal of Chemical Engineering Science*, **57**, 1639-1651.

[2] Yeon, S.H., Sea, B., Park Y.I., Lee, K.S., Lee, K.H. "Application of pilot-scale membrane contactor hybrid system for removalof carbon dioxide from flue gas. JMembr Sci. 2005; 257: 156-60.

The Market Opportunities of Hotel Investment in Semarang

Nadiar Pratiwi[1], Christiono Utomo[2], Purwanita Setijanti[1]

Abstract - Semarang is the capital city of Central Java with its greatest economic structure in the trading sector, including hotels and restaurants. Hotel investment in Semarang still has an opportunity. This research is needed to determine the best types of hotels that are possible to be built in Semarang. The method that is used in this research is surveyed by questionnaire and descriptive analysis using mean - standard deviation diagram. The types of hotels that are possible to be built in Semarang are the boutique hotel and the budget hotel with 2 star, 3 star and 4 star hotel as tourism hotel..

Term Index - Hotel, investment, Semarang.

INTRODUCTION

In 2013, Indonesia experienced a great economic growth with one of the largest investments in tourism, including hotels and restaurants [1]. Semarang is the capital city of Central Java with its greatest economic structure in the trading sector, including hotels and restaurants. Its average economic growth is 6-8% per year and contributes more than 30% per year for the city GDP [2]. One of hotel operators in Semarang stated that the average occupancy rate of hotels in Semarang from 2010 to 2013 in a row are 72,97%; 70,17%; 64,69%; 68,92%. Most of the guests are business travelers. Hotel development is recommended when the overall occupancy rate in a city is more than 50% [3]. This is related to the financial capability of a hotel to refund the cost of its investment.

The hotel investment in Semarang still has opportunities. Although there are some indications of a decline in the occupancy rate of the city, but the Average Room Rate (ARR) for any hotel continues to rise each year. So that the hotel's revenue will still be high.

There are several previous studies that are related or similar to this research. The previous studies are needed to determine the potential and current research position. Guillet et al. [4] conducted a study to find the opportunity of hotel investment in China. This research is needed because multinational hotel groups (MHGs) targeted China as the potential country for expansion of its new hotel investment. Most of the previous studies in the field of hotel investment are the feasibility study of a specific hotel in any location that the results only apply to the object studied.

Therefore, this research is needed to determine the opportunities of the types of the hotel that are possible to be built in Semarang.

METHOD

The method that is used in this research is surveyed by questionnaire. The population of this research is the experts from the hospitality industry in Semarang. The sampling technique that is used in this research is purposive sampling. And the respondents are General Manager and Hotel Manager in Semarang. The respondent selection was based on the understanding that the General Manager and Hotel Manager understand how to operate the hotels and hotel markets [5].

The study started with collecting literature on types of hotel, according to some experts. This study aims to find the variables that are used to find the opportunities of hotel properties that still possible to be built in Semarang. Furthermore, handing out the questionnaires to the respondents. Descriptive analysis using mean - standard deviation diagram is needed to find the types of hotels that are possible to be built in Semarang for hotel investment.

FINDINGS AND RESULT

The type of hotel is based on certain physical characteristics, criteria, facilities, and attributes that owned by the hotel [6]. According to Kim et, al. [7] grouping hotels by types of hotel are related to hotel services, facilities, operations and market segment. Therefore, in this research the type of hotel is a hotel grouping based on hotel target market, functional character and form. Meanwhile, star rating system or class star system is used as the technical parameters for measuring the quality standards and the provision of facilities and services at the hotel [6], [8]. In this research, it is based on the quality and type of services, number of rooms and prices.

Descriptive analysis using mean – standard deviation diagram is shown in Figure 1. This diagram is divided into 4 quadrants. The types of hotels that are possible to be built in Semarang are located in quadrant I.

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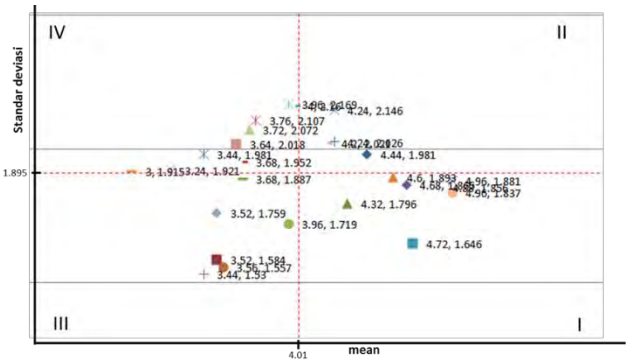

Figure 1. Mean – standard deviation diagram

Note:

: Airport Hotel Tourism	: Airport Hotel Convention
: Apartel/Condotel Tourism	: Apartel/Condotel Convention
: Boutique Hotel Tourism	: Boutique Hotel Convention
: Budget Hotel Tourism	: Budget Hotel Convention
: Motel Tourism	: Motel Convention
: Residential Hotel Tourism	: Residential Hotel Convention
: Resort Hotel Tourism	: Resort Hotel Convention
: Suites Tourism	: Suites Convention
: 1 Star Tourism	:1 Star Convention
: 2 Star Tourism	: 2 Star Convention
: 3 Star Tourism	: 3 Star Convention
: 4 Star Tourism	: 4 Star Convention
: 5 Star Tourism	: 5 Star Convention

These types of hotels that are located in quadrant I have a higher mean value and low standard deviation value. The higher the mean value, means that the type hotel has been chosen by most of the respondents which means respondents agree that this type of hotel is more likely to be built in Semarang than other types of hotel. A low standard deviation indicates that more respondents agreed to the type of hotel that is likely.

Based on descriptive analysis using mean – standard deviation diagram on Figure 1. The types of hotels that are possible to be built in Semarang are located in quadrant I. There are boutique hotel (4,32; 1,796); budget hotel (4,96;1,881); 2 star hotel (4,68; 1,865); 3 star hotel (4,72; 1,646); and 4 star hotel (4,60; 1,893). All of those types of hotel are built as tourism hotel.

CONCLUSION

It is concluded that the types of hotel that are possible to be built in Semarang are the boutique hotel and the budget hotel with 2 star, 3 star and 4 star hotel as tourism hotel.

REFERENCES

[1] Kementrian Pariwisata Republik Indonesia, "Laporan Kinerja Kementrian Pariwisata Tahun 2014", Kementrian Pariwisata Republik Indonesia, Jakarta, Indonesia, 2015.

[2] Bappeda Kota Semarang and Badan Pusat Statistik Kota Semarang, "Semarang dalam Angka 2013", Pemerintah Kota Semarang, Semarang, Indonesia, 2014.

[3] S. Rushmore, *Hotel Investment Handbook*. New York, HVS International, 2002.

[4] B. D. Guillet, H.Q. Zhang, B. W. Gao, "Interpreting The Mind of Multinational Hotel Investors: Future Trends and Implications in China", *International Journal of Hospitality Management*, vol. 30, pp. 222-232, 2011.

[5] P. Connolly, G. McGing, "Graduate Education and Hospitality Management in Ireland", International Journal of Contemporary Hospitality Management, vol. 18, no. 1, pp. 50-59. 2006.

[6] K. Cser, A. Ohuchi, "World Practices of Hotel Classification Systems", Asia Pacific Journal of Tourism Research, vol. 13, no. 4, pp. 379-398. 2008.

[7] W. G. Kim, M. H. Cho, R. A. Brymerc, "Determinant Affecting Comprehensive Property-Level Hotel Performance: The Moderating Role of Hotel Type", International Journal of Hospitality Management, vol. 34, pp.404 – 412. 2013.

[8] D. Leung, H. A. Lee, R. Law, "The Impact of Culture on Hotel Ratings: Analysis of Star-Rated Hotels in China", Journal of China Tourism Research, vol. 7, pp. 243-262. 2011.

Computational Fluid Dynamics Analysis into The Improvement of Seakeeping Characteristics of A Fast Craft Using AXE-Bow

Romadhoni[1], IKAP Utama[2], Binbin Li[1]

Abstract - It is obviously understood that hull shape affects the movement characteristics and operability of a ship. There are several ways which can be conducted in order to improve the operability of a ship one of those is by improving ship bow. Recent development known as AXE-Bow was introduced by Delft University of Technology in collaboration with DAMEN Shipyard, in the Netherlands. It was reported that the AXE-Bow can improve the seakeeping characteristics of the vessel at higher speed (Froude number above 0.60), such as reduce vertical acceleration. The current work is carried out numerically using Computational Fluid Dynamics (CFD) approach together with the use of CFD code called Hydrostar provided by Bureau Veritas (BV). The overall results showed that there are good agreement between CFD method and the work by Delft University of University and DAMEN Shipyard. Comparative studies were also carried out with published data and demonstrated similar findings

Term Index - AXE-bow, seakeeping, CFD, potential flow theory, diffraction method, strip theory.

INTRODUCTION

For recent years, fast craft ship is used for passenger ship, war ship, and rescue ship, survey and crew boat. There are many reasons for naval architect better used Axe Bow than planning Hull in fast craft ship [6]. In this fast craft ship, one of the samples is in crew boat by using Axe Bow. AXE Bow is a characteristics ships which has sharp and small hull in vertical way and looks like an axe.

A. Crew boat

Crew boat is a marine transportation vehicles used for carrying crew or workers who normally work offshore, or drilling facilities. This vessel operates just like for a passenger ship in general. This type of ship is too big and not too much carry passengers or workers, because this type of ship priority to comfort.

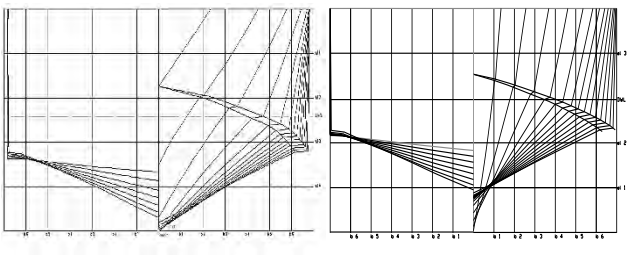

Figure. 1 Crew Boat Type Planning hull and AXE-Bow.

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Seakeeping is one of the important performances for a fast craft ship. Once the ship has been designed, it is very difficult to optimize the inherent seakeeping performance. Therefore, in order to obtain a good seakeeping performance, the ship engineers should carefully consider the ship dimensions, ship lines and other design parameters. In this paper, the seakeeping performances of the fast craft ship during concept design phase are studied with model tests and Potential Flow Theory in frequency domain by using the commercial code HydroSTAR, which is developed by Bureau Veritas (BV). According to the results, the influences of variation of design parameters (center of gravity, inertial radius, damping criteria, etc.) are given as suggestions for engineers during concept design stage.

METHOD

A. Diffraction Radiation Computation

The radiation solutions are the potential flow around the vessel when the vessel moves in the otherwise quiescent fluid. The added-mass is defined by the load on the vessel due to its unit acceleration while the radiation damping is the ratio between the load and vessel's velocity. The diffraction solutions are the potential flow around the vessel remaining immobile in incoming waves. The wave excitation loads are obtained by integrating the dynamic pressure on the fixed vessel in incoming waves. For example, the research [3]. With regard to the ship seakeeping prediction Luxury Cruise Ships with forward speed engineers introduce the assumption of low forward speed and use zero forward speed Green function to handle the problems, performed the prediction of relative motion using three dimensional pulsating source Green function with zero forward speed.

The module HydroSTAR solves the problem of diffraction and radiation around fixed and floating bodies and it's based on the following [2]:

- First and second order potential theory of free surface flow;
- Integral equations / boundary element method;
- Efficient evaluation of associated Green functions;
- Elimination of irregular frequencies;
- Independency of the mechanic properties of the system.

B. Numerical Computation

The Numerical computations are simulated in frequency domain by using commercial code Hydrostar, which is developed by BureauVeritas

(BV). Seeakeeping formula is associated with a model for considering the free liquid motion [5].

$$\left[-\left(M + M_a(\omega)\right)\omega^2 - iB_\omega(\omega)\omega + K\right]x = F\omega \qquad (1)$$

ω = Oscillation frequency
M_a = Added-mass
M = Initial matrix of the ship
B_ω = damping Component
K = Stiffness matrix
F = *Excitation load amplitude*
X = Motion amplitude

RESULT AND ANALYSIS

The result at the Froude number 0-0.2 AXE-Bow models have vertical direction relative value higher than Planning Hull Chine models, but on the Froude number 0.4-1.8 models AXE-Bow models have a value of 30-40% relative good vertical direction than the model Planning Hull. This is similar to the research conducted [4] that AXE-Bow hull have the vertical direction is better than conventional models.

Table 4. Operability Crew boat in the sea state of Natuna.

Hs (m)	0.245	0.745	1.245	1.745	2.245	2.745	3.245	3.745	4.245	4.745	5.245	5.745	Total
Operability Model HPC(%)	16.34	32.1	19.44	12.34	7.84	5.73	3.23	0	0	0	0	0	97.02
Downtime (%)	0	0	0	0	0	0	0	1.7	0.55	0.33	0.1	0.04	2.72
Operability Model HPCAB (%)	16.34	32.1	19.44	12.34	7.84	5.73	3.23	1.7	0.55	0	0	0	99.27
Downtime (%)	0	0	0	0	0	0	0	0	0	0.33	0.1	0.04	0.47

Table 4 above provides information that percentage operability crew aboard the ship model boat Planning Hull Chine (HPC) for the year was 97.02% and the time is not the operation was 2.72%, further models planning hull chine AXE Bow (HPCAB) for one year was 99.27% and the time is not the operation is 0.47%. From the comparison of the value of the operability of the model can be known AXE-Bow models have operability high compared to most other models. In other words, in a year (365 days) AXE-Bow models capable of operating for 362.34 days, the model is capable of operating Hull Planning Chine (HPC) models 354.12 days

CONCLUSION

It is concluded that the types of hotel that are possible to be built in Semarang are the boutique hotel and the budget hotel with 2 star, 3 star and 4 star hotel as tourism hotel.

REFERENCES

[1] Kementrian Pariwisata Republik Indonesia, "Laporan Kinerja Kementrian Pariwisata Tahun 2014", Kementrian Pariwisata Republik Indonesia, Jakarta, Indonesia, 2015.

[2] Bappeda Kota Semarang and Badan Pusat Statistik Kota Semarang, "Semarang dalam Angka 2013", Pemerintah Kota Semarang, Semarang, Indonesia, 2014.

[3] S. Rushmore, *Hotel Investment Handbook*. New York, HVS International, 2002.

[4] B. D. Guillet, H.Q. Zhang, B. W. Gao, "Interpreting The Mind of Multinational Hotel Investors: Future Trends and Implications in China", *International Journal of Hospitality Management*, vol. 30, pp. 222-232, 2011.

[5] P. Connolly, G. McGing, "Graduate Education and Hospitality Management in Ireland", International Journal of Contemporary Hospitality Management, vol. 18, no. 1, pp. 50-59. 2006.

[6] K. Cser, A. Ohuchi, "World Practices of Hotel Classification Systems", Asia Pacific Journal of Tourism Research, vol. 13, no. 4, pp. 379-398. 2008.

[7] W. G. Kim, M. H. Cho, R. A. Brymerc, "Determinant Affecting Comprehensive Property-Level Hotel Performance: The Moderating Role of Hotel Type", International Journal of Hospitality Management, vol. 34, pp.404 – 412. 2013.

[8] D. Leung, H. A. Lee, R. Law, "The Impact of Culture on Hotel Ratings: Analysis of Star-Rated Hotels in China", Journal of China Tourism Research, vol. 7, pp. 243-262. 2011.

Analysis of Spatial Characteristic of Maritime Weather in Java Sea

Rachmad Andri Atmoko[1], Aulia Siti Aisjah[1], Gunawan Nugroho[1]

Abstract - Sea transportation continuity is mainly affected by the sea weather. The sea voyage may be disturbed by the unpredictable weather pattern. The rate of shipping accident that is caused by the bad weather shows a high percentage. Accordingly, the study of java sea wave characteristic is required. The java sea waters especially in the north side of Java Island, between Surabaya, Semarang Banjarmasin and Makassar is one of the most dense shipping lanes in Indonesia. Several big harbors such as tanjung perak of Surabaya and tanjung emas of Semarang serve high frequency of stevedoring and passenger loading/unloading. In previous researches, the sea weather predictor of java sea waters is still temporal. In this research, numerical modeling of SWAN is used to models the sea wave propagation direction and significant height of the wave in java sea waters. This model uses the concept of spectral energy balance to describe physical interaction that happened in the sea. Two scenarios are applicated in this simulation. in the first scenario, the input of wind speeds are given from 4 direction (west, north, east and south), while in the second scenario, the wind speeds are given according to the character of seasonal winds of the research object area.

INTRODUCTION

The efficiency of marine transportation especially for cruise shipping is affected by maritime weather. The irregular pattern of weather holds a certain possibility to trouble the shipping efficiency. Some of the causes triggering shipping accident are human error as much as 41%, force majeure 38%, and hull structure 21% (MTI, Volume 2, 1-2-3 Langkah, 2007). Java Sea Water especially which spreads in the northern region of Java Island among Surabaya, Semarang, Banjarmasin and Makassar is a crowded shipping lane. Some of the considerable harbors such as Tanjung Perak in Surabaya and Tanjung Emas in Semarang serve high frequency of loading and unloading of passenger and goods. Based on the statistical data published by The Ministry of Transportation, the flow of shipping call in the operational area of *PT. Pelabuhan Indonesia III* covering the harbors in Central Java, East Java, and South Kalimantan since 2005 is increasing every year and in 2009 it reached out 72,480 units (Ministry of Transportation, 2009). In 2014, the Government launched a program named *Pendulum Nusantara* which aimed to extend the shipping routes making the shipping flow in Java Sea water become more hectic (Setkab-RI, 2012).

This research purposes to ascertain the characteristics of spatial waves in Java Sea using SWAN numerical methods; it is a numerical method of sea wave developed by DELFT University of Technology. This model is the developed model of the previous WAM and Wavewatch III. SWAN Model is proven reliable to model the propagation of sea waves in shallow and enclosed water (Rusu et al., 2012). Some of SWAN applications in the world of research are SWAN was used to evaluate the spatial distribution of sea wave energy in Azores Island, to estimate the energy of sea waves along the Caspian Sea, to evaluate the pattern of wave energy around Madeira Island (Rusu et al., 2008; 2012; 2013). Saket et al (2012) investigated the energy of sea waves along the northern sea of Oman Bay. Kim et al (2011) assess the wave sources between Korea Peninsulas and result in the prediction of wave monthly energy. Iglesias et al (2010) used SIMAR 44 data which is simulated with SWAN model to predict the potential wave energy along Dead Sea and Estaca de Bares in Spain. Akpinar et al (2013) proposed the assessment of wave energy characteristic in Black Sea. The purpose of this assessment is to ascertain the wave energy resources in that certain area. In Indonesia, there are several researches conducted by utilizing SWAN Model. Sujantoko (2009) analyzed the effect of wave refraction toward varied steepness of sea profile in Tegal Harbor. Rojali (2009) utilized SWAN Model to stimulate the propagation of wave in southern sea of Bali. The wave transformations observed are refraction, dissipation, and ruptured waves. The accuracy of SWAN has been tested in several researches conducted. Mai et al (1999) compared the result of SWAN computation to the result of measurement of waverider buoy and compared the computation using MIKE 21 wave model in the northern shore of Frissian, Germany. Based on the comparison mentioned, SWAN model is proven accurate. Silva et al (2002) compared the parameter of waves of SWAN to the result of measurement using ACDP sensor buoy in northern shore water in Portugal. The result shows conformity with tolerable rate of differences. The research problems are:

1. How are the characteristics of the propagation of significant wave height in Java Sea toward the wind with different velocity and different direction of generation?
2. How are the characteristics of direction of wave propagation in Java Sea toward the wind with different velocity and different direction of generation?

This research aims to ascertain the spatial characteristics of wave in Java Sea Water (significant propagating height of wave and wave direction). The significance of this study is to be the consideration in managing shipping lanes to increase the safety rate during the shipping..

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METHOD

A. SWAN (Simulating Wave Near shore)

SWAN Model is numerical model of wave which is used to estimate the realistic parameter of waves in the sea lines, lakes, and estuary based on the wind force, basic conditions of the water and stream. SWAN is the third generation of the model which is based completely on the spectrum. The explanation of the theory of this model, specifically for its numerical segment, is provided in the writing of Holthuijesen et al (1993) and Ris et al (1994).

SWAN is based on the action energy balance. The rate of action density changes can be explained by the equation of conservation of action spectrum Whitham, 1974; Philips, 1977; Mei, 1983; Hasselman et al., 1973):

$$\frac{\partial}{\partial t}N(\sigma,\theta)+\frac{\partial}{\partial X}c_x N(\sigma,\theta)+\frac{\partial}{\partial y}c_y N(\sigma,\theta)+ \frac{\partial}{\partial \sigma}c_\sigma N(\sigma,\theta)+\frac{\partial}{\partial \sigma}c_\theta N(\sigma,\theta)=\frac{S(\sigma,\theta)}{\sigma} \quad (2.5)$$

$$\frac{S(\sigma,\theta)}{\sigma}=S_{in}(\sigma,\theta)+S_{nl}(\sigma,\theta)+S_{ds}(\sigma,\theta) \quad (2.6)$$

CONCLUSION

1. Some archipelagos located in Sea Java Water – they are Karimunjawa, Bawean, Masalembu, and Sembilan – trigger the occurrence of wave deflection and cause dissipation of energy spreading along Java Sea Water.
2. Based on the result of the validation between the output of SWAN model and measurement data of wave buoy in four measurement points simulated since one year, the RMSE in point 1, point 2, and point 3, and point 4 is as much as 0.35664, 0.3553, 0.31794, 0.15189.

ACKNOWLEDGEMENTS

The Authors would like to thank all parties helping to succeed this study; Fresh-graduate Scholarship - DIKTI The Ministry of Education , research funding by Beasiswa Pendidikan Indonesia (BPI) - Indonesia Endowment Fund for Education (LPDP). Supporting research funding provided by BMKG Maritim II Perak Surabaya, ECMWF, GEBCO and accommodated software of SWAN version 41.01 by DELFT University of Technology.

REFERENCES

[1] BMKG (2010) .*Studi Karakteristik Gelombang laut di Perairan Selat Sunda*. Jurnal Maritim, Volume 7, 24-27

[2] Rusu E, Onea F. (2013), *Evaluation of the wind and wave energy along the Caspian Sea*, Energy, Vol. 50.

[3] Rusu E, Pilar P, Soares G. (2008), *Evaluation of the wave conditions in Madeira Archipelago with spectral models*, Ocean Eng., Vol. 35.

[4] Rusu L, Soares CG. (2012), *Wave energy fassessments in the Azores Islands*, Renew Energy, Vol. 45.

[5] Rusu E, Soares CG (2012), *Wave energy pattern around the Madeira Islands*. Renew Energy, Vol. 45(1).

[6] Saket A, Etemad-Shahidi (2012), *A. Wave energy potential along the northern coasts of the gulf of Oman, Iran*, Renew Energy, Vol. 40(1).

[7] Kim G, Jeong WM, Lee KS, Jun K, Lee ME (2011), *Offshore and nearshore wave energy assessment around the Korean Peninsula*, Energy Vol. 36(3).

Vessel Collision Avoidance System (VCAS) Based on AIS Data

Arinta Y. Wardani[1], A.A. Masroeri[1], Aulia S. Aisjah[2]

Abstract - In Indonesia, Maritime transportation delivers more than 71% of 96% to international trade in the world. It is a huge contribution to Indonesian economy. But, it is in contrary in the matter of safety. Based on National Transportation Safety Committee, there are 31 marine accidents, and around 25% of them is ship collisions which caused by human error. Accordingly, the research proposes a design of Vessel Collision Avoidance System (VCAS) based on AIS data as the input of vessel identification trajectory by using Fast Patrol Boat. As the result, this paper simulates Fast Patrol Boat maneuvering to prevent collision with another vessel.

Term Index - AIS, Collision Avoidance

INTRODUCTION

The efficiency of marine transportation especially for cruise shipping is affected by maritime weather. The irregular pattern of weather holds a certain possibility to trouble the shipping efficiency. Some of the causes triggering shipping accident are human error as much as 41%, force majeure 38%, and hull structure 21% (MTI, Volume 2, 1-2-3 Langkah, 2007). Java Sea Water especially which spreads in the northern region of Java Island among Surabaya, Semarang, Banjarmasin and Makassar is a crowded shipping lane. Some of the considerable harbors such as Tanjung Perak in Surabaya and Tanjung Emas in Semarang serve high frequency of loading and unloading of passenger and goods. Based on the statistical data published by The Ministry of Transportation, the flow of shipping call in the operational area of *PT. Pelabuhan Indonesia III* covering the harbors in Central Java, East Java, and South Kalimantan since 2005 is increasing every year and in 2009 it reached out 72,480 units (Ministry of Transportation, 2009). In 2014, the Government launched a program named *Pendulum Nusantara* which aimed to extend the shippin In Indonesia, Maritime transportation delivers more than 71% goods and people of 96% to the international trade in the world [1]. Therefore, it contributes a huge advantage to Indonesia's economics. For the reason, maritime technology develops quickly. But, it is in contrary in the matter of safety. In the last 5 years, the marine accidents in Indonesia are clustered into high level. According to the investigation result of the National Transportation Safety Committee (NTSC), there are 31 marine accidents in sea transportation, which are 8 incidents caused by collision or 25.8% of the total number of accidents. Mostly, 45% incidents were caused by human error, 38% by natural disasters (*force majeure*) and 21% by the structure of the ship (*hull structure*) [2].

Therefore, modern management of sea transportation which integrated is needed to decrease sea transportation accident. The system consists of system improvements based on navigational system, policy and safety cruise, cruise business management modernization and development of related industries [4]. In order to support the integration system, the AIS (*Automatic Identification System*) technology was installed in several type and size of ships. Currently, the technology is installed to support monitoring system in sea transportation. But, there is a several weaknesses encountered the technology. In this case, AIS could not give recommendation about direction and speed of the ship to avoid accident (crash, sail, or at the forbidden zone) [1].

Accordingly, development of early warning of Vessel Collision Avoidance System (VCAS) is needed to improve the navigational system in the ship. The system will give a response of maneuver should be taken, to avoid collision between vessels in the sea. The advice include in several positions of risk collision position based on IMO through Convention on the International Regulations for Preventing Collision at Sea (COLREGs).

METHOD

The research concerns in Fast Patrol Boat to design of Vessel Collision Avoidance System (VCAS). The principal dimensions and the isometric of the ship lines are shown in figure 1 and Table 1.

Table 1. Principel Dimensions of Fast Patrol Boat

Item	Prototype	Model
Length of Perpendicular	42,60	3,28
Breadth (B) in meter	7,80	0,6
Draft (T) in meter	1,70	0,13
Depth (H) in meter	3,50	0,27

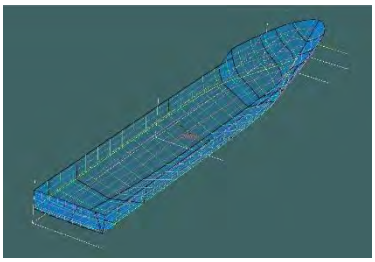

Figure1. Three-dimensional from of Fast Patrol Boat.

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In the designing of VCAS, divided into several modules, those are

(1) Module of searching data input
(2) Seakeeping behavior
(3) Collision avoidance model
(4) Numerical modeling of vessel maneuver

Those modules are integrated in system which presents a decision about collision and described in figure 3. In the process, the research takes several data information, are:

(1) Design of Wet Areas: ship maneuvering and hydrodynamic behavior, approach channels, maneuvering areas within the port.
(2) Marine environment factor :average of the speed and direction of ocean currents, wave height, speed and direction of wind.
(3) Type of Fast Patrol Boat: Dimensions, and speed
(4) The coordinates of the position of the dock.

RESULT AND DISCUSSION

The simulation gives result to illustrate manoeuvrability of head-on situations between reference vessel; a Patrol Boat with target vessel, in standby position and moving. Illustrated between patrol boat and another vessel, in which is described figure below.

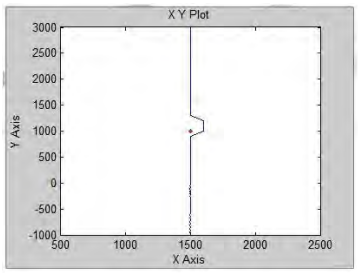

Figure 2. Head-on Condition between Patrol Boat and Standby Vessel

Figure 2 illustrated a schematic relation between reference vessel, a Patrol Boat when encounter in head-on situation. The course of target vessel keeps the distance in standby position axis 1500 meter and ordinate 1000 meter. Whilst, reference vessel, a Patrol Boat advances from axis 1500 meter and ordinate -1000 meter to 3000 meter. The KLF sets in position 100 meter form target vessel, reference vessel will be maneuvering in portside area, from ordinate position 987,3 meter. Then, the reference vessel gets stable maneuvering condition in 1203 meter.

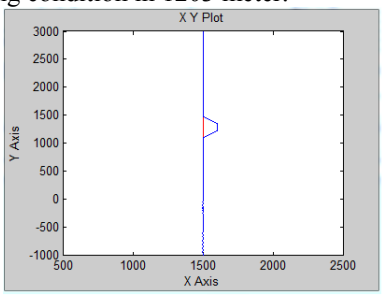

Figure 3. Head-on Condition between Patrol Boat and Advancing vessel

Figure 3 illustrated a schematic relation in difference condition. The target vessel starts to advance from axis 2000 meter to 500 meter. The advancing of target vessel will be influence the reference vessel to take maneuvering decision. Meanwhile from the opposite position, the Patrol Boat advances from ordinate -1000 meter to 3000 meter. In this research, the KLF sets in position 100 meter form target vessel length with speed less than 10 knot. Therefore, the reference vessel will be maneuvering in portside area, from ordinate position 1103 meter. Then, the reference vessel gets stable maneuvering condition in 1410 meter.

Results obtained in this study hence suggest that Fast Patrol Boat has steady maneuverability. Based on current research, it may be stated that mathematical model of Fast Patrol Boat in steady heading as heading desire. Thus, it influences its maneuvering for itself and avoids another vessel. However, more realistic simulation and free running experimental validation is suggested for future research. For example, consideration of different frequencies of waves, wind and other natural parameters may make the simulation model more pragmatic [3]

CONCLUSION

According to the research done, the following conclusion drawn:

1. The manoeuvrability of Fast Patrol Boat has been shown by simulation and numerical approach, that Fast Patrol Boat has steady heading of manuevering control.
2. The research results have shown that manoeuvrability of a Patrol Boat can be achieved in stable condition and avoid collision by minimum safe distance in more than 100 m and vessel speed less than 10 knots.

REFERENCES

[1] Aisjah, S.A et al, "MCST-Intelligent autopilot ship system increasing safety in sea navigation," in *Proceedings of the INSINAS,* pp. 9-15 , 2012.

[2] Final report of NTSC, "Investigation of sea transportation accident 12-12-04-03," [Online], Available: http://kemenhub.dephub.go.id

[3] Maimun, A., et. Al., "A mathematical model on maneuverability of a LNG tanker in vicinity of bank in restricted water," Safety Science 5, pp. 34-44, 2013.

[4] Masroeri, A.A, and Aulia S.A, "Monitoring and control of sea traffic based on improving AIS data," 2015.

Design of Tracking System and Disturbance Rejection using Neural Networks for Autonomous Underwater Vehicle (AUV)

Abdul Muis Prasetia[1], Trihastuti Agustinah[1], Joko Susila[1]

Abstract - Autonomous Underwater Vehicle (AUV) is under-actuated system with highly nonlinear dynamic and Multi Input Multi Output (MIMO). AUV has stability problem due to external disturbance. These characteristics cause the AUV is difficult to be controlled and to track the reference signal automatically. Based on these problems, this paper present tracking control design and disturbance rejection using Neural Networks for AUV with 6 Degree of Freedom (DOF). The proposed control system is used to generate control signals to overcome the nonlinear dynamics of AUV. The reference signal is processed using Line of Sight (LOS) method to obtain the desired yaw of AUV. Simulation results show that the AUV is able to track the reference signal even in the presence of ocean current disturbance.

Term Index - Autonomous Underwater Vehicle, Neural Networks, Line of Sight, ocean current, disturbance rejection.

INTRODUCTION

In this paper, we use AUV torpedo models with three actuators, the rudder, stern and propeller. Although the AUV has a simple structure, but the motion control is not easy because of the system characteristics (under-actuated system with strong nonlinear, and MIMO system) [1]. More specific cases are 3-axis motion control through the body [2,3].

In addition to the issue of tracking control, the AUV also has problems in stability caused by external disturbances, such as wave and ocean currents, and other disturbances in the form of solids. These disturbances are not only affect the AUV stability, but also on the performance and maneuverability AUV [1].

METHOD

Based on the obtained AUV model [4,5], the control stategy using Single Input Single Output (SISO) for roll, pitch, and yaw is selected (see Figure 1). The proposed control system is desired to provide good performance with fast response and minimum tracking error. Therefore, the neural network controller with 2 layers is used for each controller.

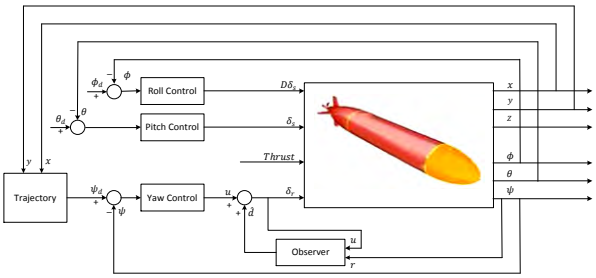

Figure 1. Control strategy

In this paper, disturbance rejection is done by using the observer. The observer design requires inverse models of the AUV system. It is difficult to obtain the inverse model of the AUV, because of the nonlinearity property. Therefore, the inverse model for yaw is approximated by a discrete model as shown in (1).

$$\frac{y(z)}{u(z)} = \frac{b_0 z + b_1 z^{-1} + \cdots + b_n z^{-n}}{a_0 z + a_1 z^{-1} + \cdots + a_n z^{-n}} \quad (1)$$

Equation (1) is the basic structure of the observer that will be converted into the form of Inverse Neural Network with weights $a_0, a_1, \ldots, a_n, b_1, \ldots, b_n$.

RESULT AND DISCUSSION

The trajectory used in simulation is as shown in Figure 2, with desired depth -10m. Simulation results show that the AUV movement can track the trajectory as depicted in Figure 3.

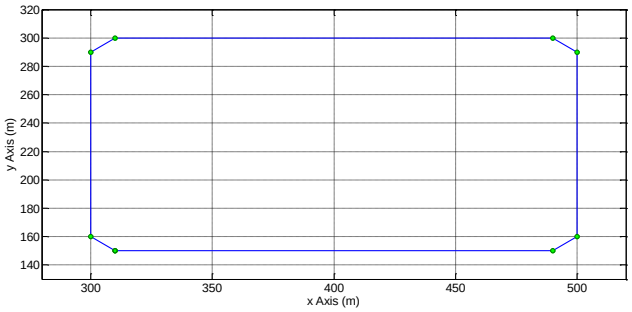

Figure 2. Trajectory

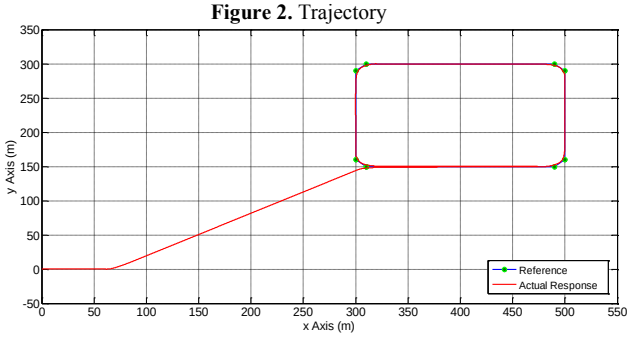

Figure 3. Movement of auv without external disturbance.

The AUV movement without any external disturbances is shown in Figure 3. The average tracking error is 0.19 m. From simulation results, it

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can be said that the proposed control system can work well.

The external disturbances is in the form of 2-dimensional ocean currents as shown in Figure 4. The velocity of the disturbance is ±1.5 m/s on the time interval $58 \leq t \leq 155$. The AUV movement in the trajectory tracking with/without the observer on the control system can be seen in Figure 5 and 6. The average tracking error without observer on the system is 7.17 m; while the average tracking error of the proposed control system is 0.24 m.

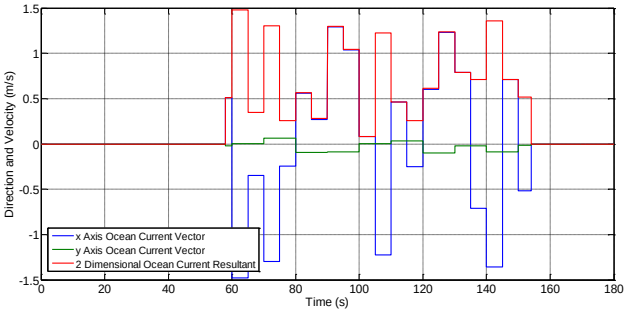

Figure 4. Ocean current disturbance.

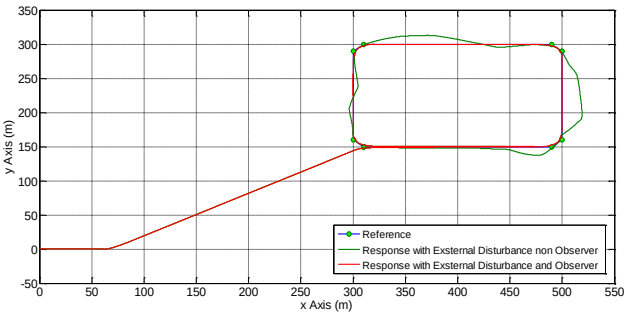

Figure 5. Movement of auv with external disturbance.

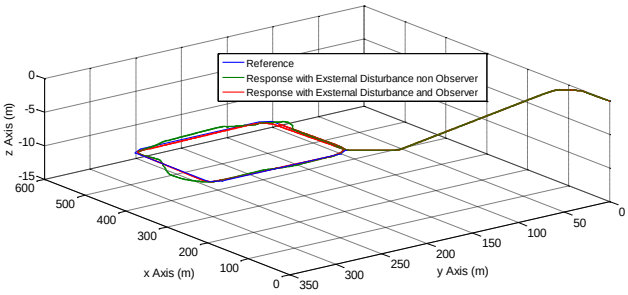

Figure 6. Movement of auv in xyz axis with external disturbance.

CONCLUSION

In this paper we present the tracking system and disturbance rejection design using Neural Network control method for AUV. The proposed control system is able to control the movement of the AUV to track the trajectory with an average tracking error of 0.19 m. If the external disturbance is present, the control system still work well with an average tracking error of 0.24 m.

REFERENCES

[1] C. Walter, Y. P. Kristin, T. G. Jan and B. Even, "Path Following of Underactuated Autonomous Underwater Vehicles in the Presence of Ocean Currents," *51st IEEE Conference on Decision and Control*, Hawaii, 2012.

[2] K. Ishaque, S. S. Abdullah, S. M. Ayob and Z. Salam, *Single Input Fuzzy Logic Controller for Unmanned Underwater Vehicle*. Universiti Teknologi Malaysia, 2010.

[3] E. Gamal, "Performance and Stability Analysis of an Autonomous Underwater Vehicle Guidance and Control," *Proceedings of Intemational Conference on Modelling, Identification & Control*, Egypt, 2013.

[4] F. Thor, *Handbook of Marine Craft Hydrodynamics and Motion Control*, Trondheim: John Wiley & Sons Ltd., 2011.

[5] R. Peter, F. Julien and C. Corke, "Submarine Dynamic Modeling," *Australian Conference on Robotics & Automation*, Brisbane, 2003.

Analysis of N-nitrosodiprophylamines Carcinogenic Compound in Meat-Processing using Headspace-Single Drop Microextraction-Gas Chromatography-Flame Ionization Detector (HS-SDME-GC-FID)

Teguh Hari Sucipto[1], Ganden Supriyanto[2], Yanuardi Raharjo[2]

Abstract - Analysis of N-nitrosodiprophylamines carcinogenic compound in processed meat especially hamburger and kebab had occured by HS-SDME-GC-FID technique. The results were obtained determining the optimum pH was 4, the optimum stirring speed was 6 scale, and the temperature of extraction was 30 ºC. It was obtained in this study that the detection limit of 78 ppb, the percent recovery of 101,18%, precision between 0,089% to 0,566%, and the true enrichment factor was 3372,66 times. From the results of the study was concluded that HS-SDME-GC-FID technique can be used to analyze the carcinogenic compound N-nitrosodiprophylamines (NDPA) found in meat-processing (hamburger and kebab) by the concentration of each samples as follows, hamburger I of 0,27 ppm, hamburger II of 0,73 ppm, hamburger III of 1,39 ppm, and kebab I of 3,13 ppm.

Term Index - HS-SDME-GC-FID technique, N-nitrosodiprophylamines, Meat-processing.

INTRODUCTION

The cause of cancer was caused by nitrosamine compound that attacks on certain organs, such as stomach [1]. The results of the various species of animals declared that nitrosamines were carcinogenic. In addition, nitrosamines were also toxic and mutagenic [2]. The level of tolerance N-nitrosamines in the human body ranges from 5 to 10 mg/kg of weight human body [3].

Based on the description above, considered the N-nitrosamines in this case NDPA was carcinogens in the human body and cause cancer, the need for an analytical technique that was simple and has a high sensitivity properties to detect the presence of N-nitrosodiprophylamines (NDPA) in the food. Based on the properties of N-nitrosamines volatile (volatile), the HS-SDME extraction techniques (Headspace-Single Drop microextraction) very efficiently can be used. HS-SDME extraction technique has several advantages, namely avoiding the extraction with organic solvents when the contaminant in samples that may interfere with the analysis. In addition, HS-SDME extraction technique was also simple, easy, and does not require a long time of extraction. The existence of N-nitrosamine compounds can be identified using the instrument GC (Gas Chromatography). Gas chromatography (GC) was an analytical technique that can be used to identify chemical compounds with properties easily evaporated [4] and can detect samples up to µg/L.

METHOD

In this study used to extract compounds toluene nitrosodipropilamin (NDPA). A total of 10 ml of standard solution (for example, a standard solution of 6 ppm NDPA) was inserted into the bottle containing a magnetic stirring bar. Microsyringe already contain organic solvents (eg, toluene as much as 3 mL) was inserted into the bottle vertically up hanging over the standard solution. Then the microsyringe tip was pressed so that the organic solvent hangs at the end of the needle. Then NDPA standard solution was stirred using a magnetic stirrer. After the extraction process was completed, the organic solvent was pulled back into a microsyringe and injected directly into the GC-FID instruments, and the resulting area for the standard concentration.

VALIDATION OF ANALYTICAL METHODS

The calculation of the Limit of Detection (LOD) NDPA, earned value detection limit of 78 ppb. This value was the smallest concentration limits can still be responded by Gas Chromatography. While the limit of detection for the calibration curve obtained without the extraction of 0.86 ppm. By comparing the value of the detection limit without extraction of NDPA measurement and limit detection NDPA measurements with HS-SDME extraction showed that the HS-SDME extraction method capable of increasing the sensitivity of GC-FID to provide a response to NDPA. It can be concluded that with the extraction method using the HS-SDME sensitivity GC-FID being very high [5].

Calculation% recovery between 99.87% and 105.65%, of the value can be inferred that the extraction method in determining the HS-SDME NDPA has good accuracy, or it can be said that this extraction method is actually closer proximity NDPA concentration. No recovery value that indicates 105.65% due to other compounds that give the same signal at the retention time NDPA.

Method can be said to have the accuracy or precision was good if the value of the coefficient of

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variation (CV <3%) [6]. It can be concluded that the accuracy or precision produced by GC-FID used for the analysis of NDPA compounds in the sample, as evidenced by the resulting coefficient of variation of 0.089% to 0.566%.

Theoretical enrichmen factor (EF_{th}) was amounted to 3333.33 times. According to the theoretical concentration that occurs in the extraction process using the HS-SDME NDPA at 3333.33 times. While the actual or true concentration enrichment factor (EF_{tr}) amounted to 3372.52 times. So it can be concluded that the concentration process that occurs in the extraction using the HS-SDME good, because the results have EF_{th} not so much difference with EF_{tr}.

CALIBRATION CURVE OF NDPA

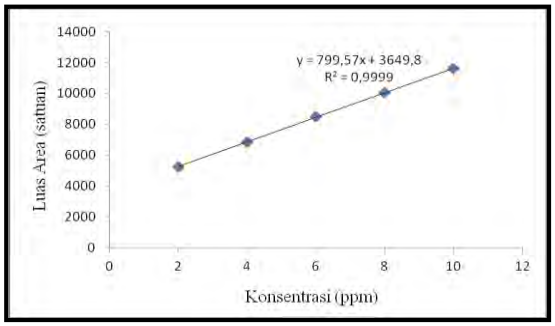

Figure 1. Calibration curve of NDPA with HS-SDME.

Calibration curve of NDPA with HS-SDME the analytic parameters optimum conditions. Calibration curve of NDPA with the extraction of HS-SDME was obtained by linear regression y = 799.57x + 3649.8 with correlation coefficients (R2) of 0.9999. It shows there was a correlation between the concentrations of NDPA an area of the chromatogram.

SAMPLES ANALYSIS

Table 1. Data of NDPA concentration in the samples

Samples	Concentration (ppm)
	A
Hamburger	0,27
Kebab	3,13

CONCLUSION

Methods of HS-SDME-GC-FID can be used to analyze compounds N-nitrosodiprophylamines (NDPA) was contained in processed meats (hamburger and kebab). This method has a detection limit of the HS-SDME-GC-FID method was 78 ppb, the percent recovery of 101.18%, the precision between 0.089% to 0.566%, the theoretical enrichment factor of 3333.33 times, and a true enrichment factor 3372.66 times.

REFERENCES

[1] Domanska-Blicharz, K., Rachubik J., Kowalski, B., 2005, Occurrence of Volatile N-Nitrosamines in Polish Tinned Foods, *Bull Vet Inst Pulawy*, 49, 319-322

[2] Andrade, R., Reyes, F.G.R., Rath S., 2005, A Method For The Determination of Volatile N-Nitrosamine in Food by HS-SPME-GC-TEA, *J. Food Chem.*, 91: 173-179

[3] Filho, P.J.S., Rios, A., Valcárcel, M., Zanin, K.D., Caramão, E.B., 2003, Development of a New Method for The Determination of Nitrosamines by Miceller Electrokinetic Capillary Chromatography, *Water Research,* 37: 3837-3842

[4] Riccio, D., Wood, D.C., Miller, J.M., 2008, Using Single Drop Microextraction for Headspace Analysis with Gas Chromatography, *J. of Chem. Education*, 85(7), 965-968

[5] Sleiman, M., Maddalena, R.L., Gundel, L.A., dan Destaillats, H., 2009, Rapid and Sensitive Gas Chromatography-Ion-Trap Tandem Mass Spectrometry Method for The Determination of Tobacco-Specific N-Nitrosamines in Secondhand Smoke, *J. of Chrom. A*, 1216, 7899-7905

[6] Miller, J.C., dan Miller, J.N., 1988, *Statistics for Analytical Chemistry Second Edition*, Elllis Horwood Limited, England

Analysis of The Dynamic Stability Positioning Control System of Semisubmersible

Aulia Siti Aisjah[1], Eko Budi Djatmiko[2], Riza Aris Hikmadiyar[1], Nur Kholis[1]

Abstract – The semisubmersible offshore dynamics depend on the condition of the ocean environments. Disruption of forces and moments in the floating structure caused by environment factors, there are wind, waves and ocean currents. This disturbances will cause decreased stability of the structure. This situation will disrupt the process of oil and gas exploration. Currently exploration activities is success if the structure in the static condition and remain on. This condition needs a force or torque to counter the disruption caused by the environment. This paper proposes a control system and analyze the performance of response stability of dynamic positioning system (DPS). DPS will control in 3 Degree of Freedom (DOF) variables, there are: sway, roll and yaw. The structure of the DPS consists of controllers, sensors, actuators. Actuators are Thruster System and Power System. The strategic to maintain in DPS is Linear Quadratic (LQG) control. This method is one of optimal control which capable rejected wave interference. Some values control parameters, that are Q and R in the cost function, show the robustness of DPS.

Index Terms – DPS, LQG, Q dan R, platform offshore.

INTRODUCTION

Offshore platforms is maintained at stationary condition of dynamic stability. This condition in the position and orientation desired. The platform is equipped with the appropriate propulsion systems to compensate for the power of ocean waves, wind and currents induced.

Platform is a nonlinear dynamics model, this is caused by the shape of the hull is stiff and strong ocean hydrodynamic interactions [1]. Non-linear models such require a control system that is able to estimate the values of parameters, so that the control signal is able to cope to the uncertainty of parameter changes

The control system is used to determine the appropriate balancing force, when the floating building is shift or change to its orientation. Control systems have a robustness due to environmental influences. The performance control is needed to maintain the stability of the position [1].

In some floating structures and vessels, anchors is used to stabilize their position. The controller to compensate force and moments of anchor, so floating objects in expected position. Variables of structure dynamics shown in 6 dof. Control variables are surge, sway and orientation (yaw) as expected [2]. In other scenario, the DSP control variables are surge, sway and yaw [3]. Control strategy in various types, ie: a conventional and based on expertise. Some strategies for dynamic positioning control system has been proposed by some researchers, which control system PID - ANN, fuzzy logic control system [2]. Dynamics positioning system is a control system that determine to what position and direction stability conditions [5].

MATERIAL AND METHOD

The design of the control system, starting with determination of the platform dynamic models. Model dynamics is expressed in the 3 d.o.f., ie; sway, roll, and yaw variables. The case studies carried out on the Atlantis PQ semisubmersible rig platform. Platform dynamics model is derived based on the vessel models [5].

Non linear models of spring-mass-damper as analogy of platform structure can be used as a reference model in PID control system [6]. The model in the polynomial transfer function of s. The state space equation models is used in optimal control system design. This system is expected to provide optimum signal value on rotation azimuth thruster [7].

Dynamics equations is expressed in the following form: in sway, roll and yaw motion.

$$m[\dot{v} - Y_G(r^2 + p^2) + Z_G(-\dot{p}) + X_G(\dot{r})] = Y \quad (1)$$

$$I_x\dot{p} + m[Y_G(vp) - Z_G(\dot{v})] = K \quad (2)$$

$$I_z\dot{r} + m[X_G(\dot{v}) - Y_G(-vr)] = N \quad (3)$$

The third equation (1) – (3) is formed in the state space equation of (4).

$$\mathbf{M}\dot{\mathrm{v}} + \mathbf{D}\mathrm{v} = \tau_{\mathrm{L}} \quad (4)$$

M: inertia matrix, D: damping matrix and τ_L is force and torque of actuator. The actuator is thruster as DPS components. The type of thruster in the design of control is *Rotatable (Azimuth) Thruster*.

The model is approached with slender body theory. The model transformed in the form of non-dimensional using the bis system [8]. The form of equation (4) with the disturbance factors is expressed in the equation (5),

$$\boldsymbol{M}\dot{v}_L + \boldsymbol{D}v_L = \tau_L + w_L \quad (5)$$

Where w_L is environment factors.

LQG is composed of Linear Quadratic Regulator and Kalman Filter. Block diagram of LQG is shown in the Figure 1.

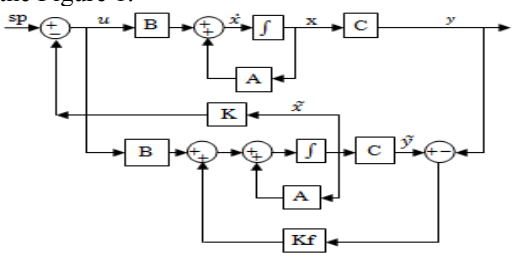

Figure 1. LQG control

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The matrix of A, B, C is resulted from state space equation models. A is matrix of system, B is input matrix and C is output matrix. K is gain of control and Kf is gain Kalman filter.

RESULT

The variation of gain parameter of LQG controller is shown in Table 1. The minimal cost function – J when the Q = R = 0.00001.

Table 1. The value of gain parameter of LQG control and cost function J

No	*Q*	*R*	J
1	20	10	0.0622
2	15	10	0.0530
3	10	10	0.0481
4	5	10	0.000309
5	5	5	4.670122
6	0.0001	0.0001	0.000129
7	1	0.1	34.663000
8	1	0.01	40.846242
9	1	0.001	43.3291900
10	1	0.0001	46.194800

Response of yaw and sway motion when the wave disturbances is shown in figure 2 and 3.

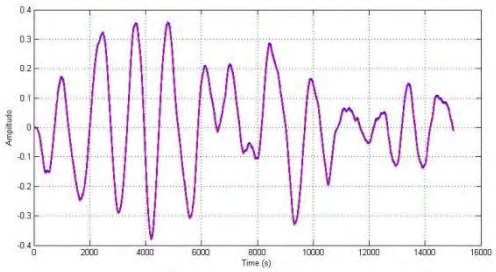

Figure 2. Sway response of platform in wave disturbances.

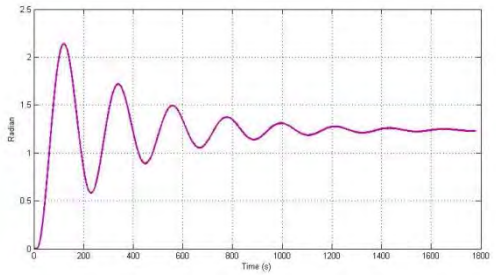

Figure 3. Yaw response of platform in wave disturbances.

CONCLUSION

From the results and discussion that has been Described in above, it can be concluded that:

1. The design of gain regulator K and gain of Kalman Kf for each value of Q = 0.0001, R = 0.0001 and value Qn = 0.001, Rn = 0.001.
2. LQG control system is able to take action to control the interference waves and gaussian so that platforms are still able to follow the set point.
3. Error steady state is small and in the limit of critical tolerance.

REFERENCES

[1] K. D. Do, "Global Robust and Adaptive Output Feedback Dynamic Positioning of Surface Ships," in *IEEE International Conference on Robotics and Automation*, 2007, no. April, pp. 4271–4276.

[2] C.-C. Chien, Ting-Li; Lin, Chia-Wei; Huang, Chiou-Jye; Chen, "Dynamic positioning control of marine vehicle," *Int. J. Innov. Inf. Control*, vol. 8, no. 5, pp. 3361–3385, 2012.

[3] Z. Fang, Ming-chung; Lee, "Portable Dynamic Positioning Control System on A Barge in Short-Crested Waves Using the Neural Network Algorithm *," *China Ocean Eng.*, vol. 27, no. 4, pp. 469–480, 2013.

[4] American Beruau of Shipping, *GUIDE FOR DYNAMIC POSITIONING SYSTEMS*, vol. 2013, no. July. Houston, 2014, pp. 1–82.

[5] C. P. Tannuri, Eduardo Aoun; Kubota, Leonardo Kenji; Pesce, "ADAPTIVE TECHNIQUES APPLIED TO OFFSHORE DYNAMIC POSITIONING SYSTEMS," in *Proceeding of The XI DINAME*, 2005, pp. 1–10.

[6] C. K. Morooka, "Dynamic Positioning System of Semi-Submersible Platform Using Fuzzy Control," *J. Braz. Soc. Mech. Sci. Eng.*, vol. XXVII, no. 4, pp. 449–455, 2005.

[7] C. C. Liang and W. H. Cheng, "The optimum control of thruster system for dynamically positioned vessels," *Ocean Eng.*, vol. 31, pp. 97–110, 2004.

[8] T. I. Fossen, *Guidance and Control of Ocean Vehicles - Thor I. Fossen.pdf*, 1st ed. Trondheim: British Library, 1994, pp. 1–494.

HAZOP Study Based on ANFIS Layer of Protection Analysis in Unit Kiln PT. Semen Indonesia Factory Tuban

Henry Prasetyo[1], Ali Musyafa'[1]

Abstract - Process safety and risk assessment are vital demand for any industry to characteristic hazard and their for personnel, environment and loss of money. Unit Kiln are part of industrial cement, operated at high temperature and high pressure. Security so the process must be maintained so as not to pose a hazard with a high risk. Risk matrix is a very useful tool to estimate of process or equipment that helps decision making process. HAZOP (Hazard and Operability) study is one method to know risk assessment. Thus ANFIS logic method for risk assessment is selected as a new and efficient way to industry resource management. This study generally include quantitative review of possible accident, based on previous accident experiences that may occur in a typical process in unit kiln. For the HAZOP study the possible exist to limit failure in case definition and risk modeling to only accident that may include fire, exploitation and toxic effect risks. Consequence a ANFIS risk matrix is based on Layer Of Protection Analysis (LOPA) and HAZOP Study procedure for analyzing. The result from this research that have be done study HAZOP unit kiln PT. Semen Indonesia Factory Tuban and also know risk impact and get SIL rating for this plant.

Term Index - HAZOP, ANFIS, Unit Kiln, LOPA.

INTRODUCTION

Nowdays, Artificial Intelligent (AI) computational methods, such as knowledge-based system, neural network, genetic algorithm, and fuzzy logic, have been increasingly applied to several industrial researcher. Chemical and process unit contain huge amount of dangerous chemical product and substances that may be exposed to any kinds of hazard, like natural and process hazard [1]. In recent years cement industry, quantitative risk analysis have provided valuable information for decision process in the planning phase [2]. Risk analysis techniques based on particular characteristics are divided into four categories: deterministic, probabilistic, quantitative and qualitative. Some methods of risk analysis are: HAZOP, Event Tree Analysis (ETA), Fault Tree Analysis (FTA), Quantitative Risk Assessment (QRA), Layer of Protection Analysis (LOPA) that is used to identify potential accident scenarios, estimate their likelihoods and consequences and improve system safety and operation. However, knowledge is developing rapidly, but there is still lacking and uncertain process information, implicit in the variable, model and in the large accident hazard consequently [3].

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METHOD

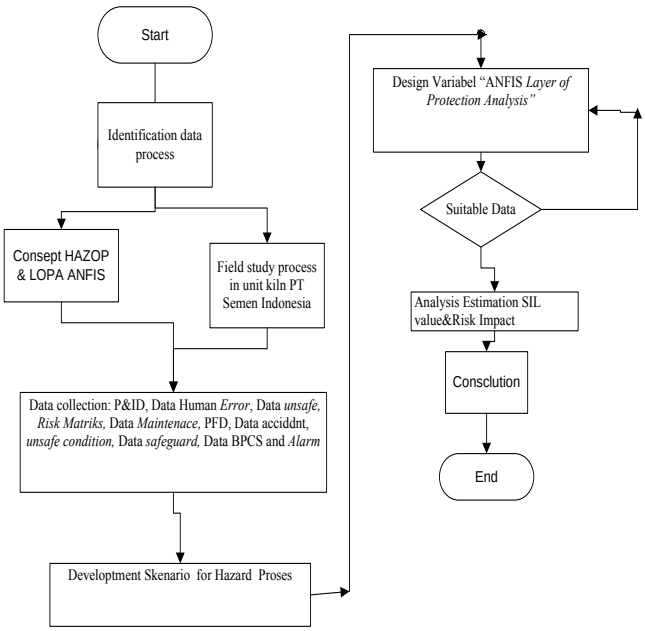

Figure 1. Flowchart Research Method

Adaptive Neuro Fuzzy Inference System (ANFIS) is one modern method that can be used in implementing an assessment, estimations and prediction qualitatively and quantitatively. ANFIS is merger of Fuzzy Inference System (FIS) mechanism, which is described in the neural network architecture.

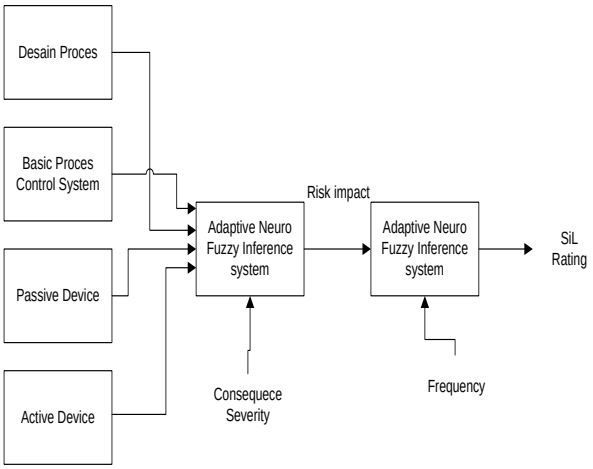

Figure 2. Architecture Adaptive Neuro Fuzzy Inference System Layer of Protection Analysis (ANFIS LOPA) for search SIL.

RESULT AND DISCUSSION

Analysis severity risk impact based on ANFIS look at surface view in picture 3.1. Unit Kiln in PT. Semen

Indonesia divided 4 node: node 1 (process in blending silo and kiln feed), node 2 (suspension preheater), node 3 (rotary kiln) and node 4 (clinker cooler). Surface view ANFIS for risk impact:

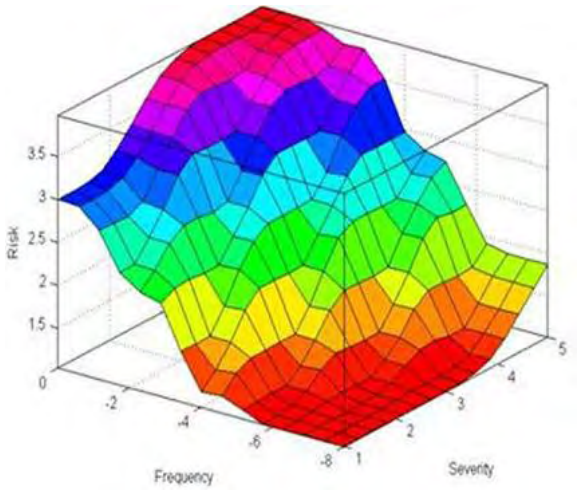

Figure 3. Surface Viewer for Seveity Risk Impact

Risk impact assesment for node 1- node 4 show that picture 3.2

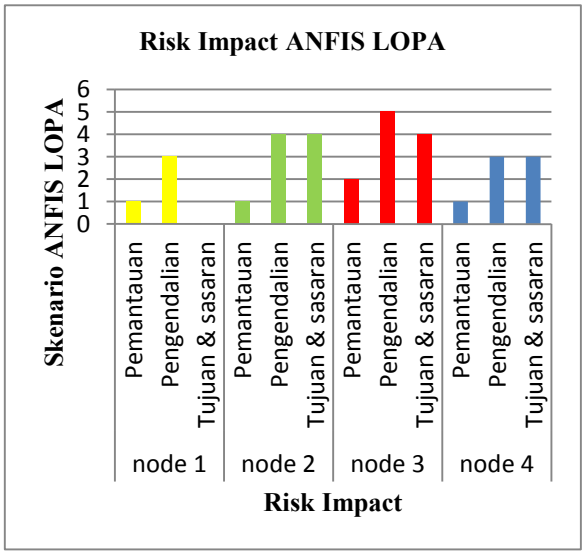

Figure 4. Risk Impact with ANFIS LOPA for node 1- node 4

For search SIL rating, see the table 3.1

Table 1. SIL rating

Node	SIL Rating	Scenario Fuzzy
1	SIL 1	1
2	NR	1
	SIL 1	3
3	NR	2
	SIL 2	3
	SIL 3	5
4	SIL 1	2
	SIL 2	3

CONCLUSION

Based in the research and analysis, can get concluded that have be done study HAZOP Unit Kiln PT. Semen Indonesia Factory Tuban and also know risk impact and get SIL rating for this plant. For node 1 get SIL 1, node 2 get SIL 1, node 3 get SIL 3 and node 4 get SIL 2.

REFERENCES

[1] Gharibi H, Mahvi AH, Nabrizadeh R, Arabalibeik H, Yunesiana M,Sowlat MH(2012). A Novel approach in water quality based on fuzzy logic, Journal of enviromental management, vol (112),87-95

[2] Markowski A S, Mannan M S, Bigoszewska A (2009). Fuzzy logic for process safey analysis, Journal of loss prevention in the process industries,vol(22) 695-702

[3] Khaleghi, Sohrab. Givehchi, Saeed. And Karimi, Saeed. (2013). Fuzzy Risk Assesment and Categorization, based on Event Tree Analysis(ETA) and Layer of Protection Analysis (LOPA); case study in cement industry. World Applied Programming Journal, vol(3) Issues (9) 417-426

Design of Model Predictive Torque Control (MPTC) for Speed Control 3 Phase Induction Motor with Robust Stator Flux Observer

Halim Mudia[1], Mochammad Rameli[1], Rusdhianto Efendi[1]

Abstract - ***The induction motor is a desirable alternative to the direct current motor in many applications because it is rugged, reliable and economical. However, control of the induction motor is more complex than the direct current motor, this is caused by the complexity of the dynamics of the induction motor, so the algorithm of induction motor is more complex. Based on these problem, author conducted a study on the induction motor using Model Predictive Torque Control (MPTC) with robust stator flux observer, in which robust stator flux observer is designed to overcome the shortcomings in the Direct Torque Control (DTC) conventional which can cause high fluctuation in flux ripple and torque ripple when reach steady state condition. So from the purpose of the proposed method, the results of the designed system can adjust the rotating speed of the induction motor in accordance references given at 120 rad/s with a settling time is 0.753 seconds, and also can minimize fluctuations in flux ripple and torque.***

Term Index - Direct Torque Control, Induction Motor, Model Predictive Control, Robust Stator Flux Observer.

INTRODUCTION

In this research, the propose of design speed control of induction motor 3 phase is equipped with three main parts, controller (model predictive control and propotional-integral), direct torque control, robust stator flux observer, and induction motor model, depicted in Fig. 1.

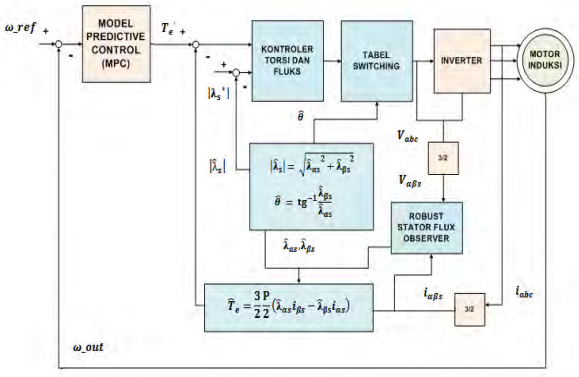

Figure 1. Block diagram of the system induction motor.

Based on system induction model, the control strategy Single Input Single Output (SISO) is designed and realized with Model Predictive Torque Control (MPTC) with robust stator flux observer to control the speed of three phase induction motor using matlab, where robust stator flux observer can be designed with the following equation:

$$\hat{x}(k+1) = (A_n + \Delta A)\hat{x}(k) + Bu + H(\hat{\imath}_s(k) - i_s(k))$$

$$\hat{\imath}_s(k) = c\hat{x}(\mathrm{k}) \qquad (1)$$

Where the mathematical model of the induction motor is expressed by:

$$\begin{bmatrix} V_{qs} \\ V_{ds} \\ V_{qr} \\ V_{dr} \end{bmatrix} = \begin{bmatrix} R_s + pL_s & \omega_e.L_s & pL_m & \omega_e.L_m \\ -\omega_e.L_s & R_s + pL_s & -\omega_e.L_m & pL_m \\ pL_m & (\omega_e - \omega_r)L_m & R_r + pL_r & (\omega_e - \omega_r)L_r \\ -(\omega_e - \omega_r)L_m & pL_m & -(\omega_e - \omega_r)L_r & R_r + pL_r \end{bmatrix} \begin{bmatrix} i_{qs} \\ i_{ds} \\ i_{qr} \\ i_{dr} \end{bmatrix} \qquad (2)$$

The mathematical model of the induction motor load is expressed by the equation:

$$\tau_e - \left(\frac{N_1}{N_2}\right)^2 \left(B_b\omega_m + J_b\frac{d}{dt}\omega_m\right) - B_r\omega_m = J_r\frac{d}{dt}\omega_m \qquad (3)$$

RESULT AND DISCUSSION

Results of design speed Control 3 phase induction motor with robust stator flux observer can be seen in the following figure:

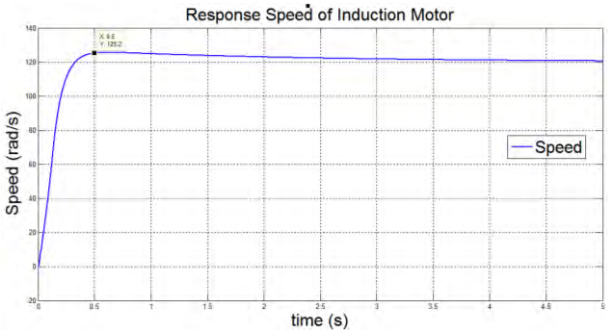

Figure 2. Response Speed of Induction Motor Using controller proportional-integral Direct Torque Control with load (Reference = 120 rad/s)

In figure 2. It can be seen that the value of the response speed by using a load at the time of t = 0.5 second is 125.2 rad /s

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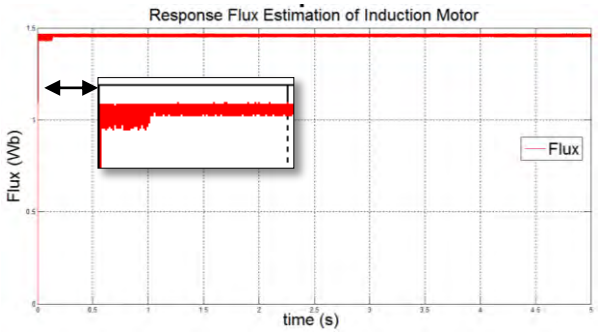

Figure 3. Response flux Estimation of Induction Motor using controller proportional-integral Direct Torque Control with load

Based on the results in figure 3 and figure 5 that the Direct Torque Control (DTC) with robust stator flux observer can minimize ripple fluctuations flux in the steady state, and the results in figure 2 and figure 4 that the Model Predictive Control (MPC) can keep speed in accordance with the speed reference.

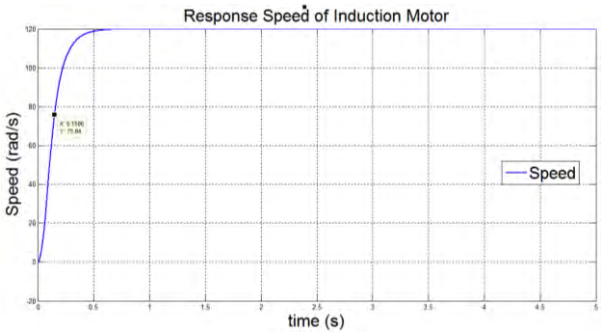

Figure 4. Response Speed of Induction Motor using model predictive torque control robust stator flux observer With Load (Reference = 120 rad/s)

In Figure 3. After using the Model Predictive Torque Control (MPTC) with robust stator flux observer, the response speed can reach the specified reference value of 120 rad/s with the value of the time constant (τ) to speed response in Figure 4.15 is 0.1506 seconds, and settling time obtained for 0.753 seconds.

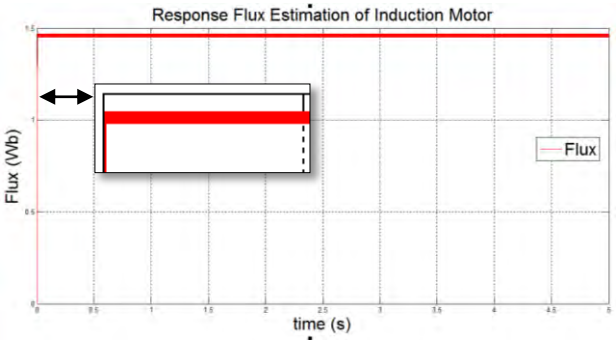

Figure 5. Response flux Estimation of Induction Motor using model predictive torque control robust stator flux observer With Load.

REFERENCES

[1] Bose, K. B. "Modern Power Electronics and AC Drives", *Prentice Hall*, Knoxville, 2002.

[2] Ramesh, T., Panda, K. A. "Direct Flux and Torque Control of There Phase Induction Motor Drive Using PI and Fuzzy Logic Controllers for Speed Controller for Regulator and Low Torque Ripple ". *Department of Electrical Engineering, National Institute of Tecnology*, India, 2012.

[3] Diab, Z. A. A., Pankratov, V. V. "Model Predictive Control of Vector controlled Induction Motor Drive", *IEEE* 2012 7th International Forum on *Strategic Technology (IFOST)*, Russia, 2012.

[4] Sun, D. "Sliding Mode Direct Torque Control for Induction Motor with Robust Stator Flux observer", *IEEE 2010 International Conference on Intelligent Computation Technology and Automation*, China, 2010.

Effects of Acetic Anhydride toward Degree of Substitution on Acetylation Method of Sago Starch (*Metroxylon sp*) from Papua

Yuliya Andriani Nanggewa[1], Adi Setyo Purnomo[1], Surya Rosa Putra[1]

INTRODUCTION

Sago contains carbohydrates that are stored in the starch form. Starch is generally formed from two molecules of glucose polymer, namely amylose and amylopectin, which its composition varies for each type of starch [1]. The weakness of starch can be overcome through a modification of the functional properties of starch to expand sago starch. Chemical modification of starches can enlarge the range of certain starch physical properties of the parent starch [2] and enhance their use in a number of applications found in industrial processes and food manufacture. Chemical modification of starch can be performed by various methods such as acetylation.

Generally, native starch has a low Degree of Substitution (DS) because of their limited degree or reaction on the granule surface. Increasing DS can be obtained by modification of native starch through acetylation reaction using few catalysts such as pyridine and NaOH. Several researchers have reported the effects of acetylation on many sort of starch sources such potato, corn, pea and cassava [3-5]. There are few studies about the effects of acetylation of starches with a wide range of amylose contents. We have carried out some work on effects of acetic anhydride concentration toward DS value of native and modified sago starch from Papua.

METHOD

A. Acetylation with acetic anhydride

In this study, sago starch was modified by acetic anhydride with various concentrations. Sago starch was acetylated according to the method described by [6] with few modifications. Sago starch was pre-gelatynitated by mixing 500 g sago starch into 550 mL De-ionized water and stirring at 70 °C for 20 min. Subsequently, it was precipitated by adding ethanol of 96% and washing with acetone. Starches of 25 g were added into acetic anhydride and pyridine with rasio of ½:1 and 1:1. The mixture were reacted at 50 °C for 1 h, cooled, precipitated by ethanol, filtered and dried at 50 °C. The acetylated starches were denoted as AS-0.5 and AS-1.

B. Characterization

Fourier transform infrared spectra (4,000-500 cm^{-1}, resolution 4 cm^{-1}) of native starch and modification starch were recorded with a Shimadzu FTIR spectrometer.

The percentage of acetyl groups (Ac %) and the degree of substitution (DS) of acetylated starches were determined by the titration method described by [6].

RESULT AND DISCUSSION

Acetylation of starches is an important substitution method that has been applied to starches that impart the thickening needed in food application. Acetylated starches with low degree of substitution (DS) are widely used in food industries. Therefore in this study, sago starch was modified by acetylation method with various concentration of acetic anhydrate to obtain acetylated starch with low degree of substitution (DS).

A. FTIR analysis

FTIR spectroscopy analysis was used to monitor changes in the structure of the starches promoted by acetylation by analyzing the frequency and intensity of the peaks. Fig. 1 shows FTIR spectra of the native and acetylated starches. The native starch presented strong peaks in the 3000-3600 cm^{-1} and 2950 cm^{-1} regions, which correspond to OH and CH stretching, respectively; peak at 1650 and 1420 cm^{-1} correspond to OH and CH bending [7].

Acetylated starches had strong absorption band at 1735-1740 cm^{-1} which attribute to C=O stretching of acetyl group, band at 1368 cm^{-1} which attribute to C-H in acetyl group and band at 1234 cm^{-1} which attribute to C-O stretching of acetyl group with evidence of acetylation [8]. The 1740 cm^{-1} peak increased as amount of acetic anhydrate increased from 50 g to 100 g. on the other hand, since the intensity of the hydroxyl group peak at 3000-3600 cm^{-1} decreased, it has been suggested that the hydroxyl groups in the starch molecules were converted into acetyl groups.

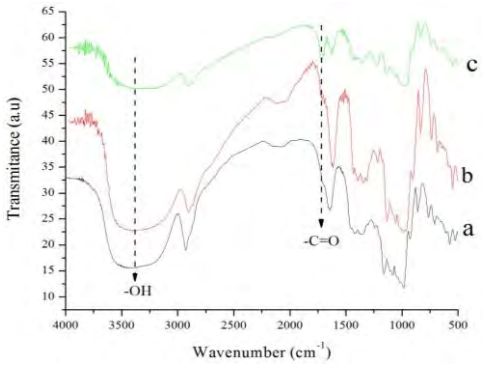

Figure 1. FTIR spectra of (a) native starch, (b) AS-0.5 and (c) AS-1

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B. Percentage of Acetyl Groups (Ac%) and Degree of Substitution (DS)

Table 1 shows the effect of acetylation with different concentration of acetic anhydride on percentage of acetyl groups (Ac%) and Degree of Substitution (DS) of acetylated starches. *Ac%* and DS of starches increased significantly with increasing acetic anhydride. The acetylated starches showed DS ranging between 0.08 and 0.11. Acetylated starches with low DS are used in food industry as agents of texture, consistency and stability in food and currently being studied in the development in biodegradable packaging and pharmaceutical applications. Starches with medium DS may be applied as substitutes for thermoplastic cellulose acetates [9].

Table 1. Acetyl percentage and degree of substitution contents of acetylation treated starches

Acetylation starches	Acetyl (%)	Degree of substitution
Native	-	-
AS-0.5	2.15	0.08
AS-1	2.85	0.11

CONCLUSION

In conclusion, the introduction of acetyl groups was confirmed by FTIR spectroscopy with the present of carbonyl groups. Different concentration of acetic anhydride in the acetylation reaction promoted *Ac%* and DS changes in starches. The acetylated starch with highest concentration (100 g) of acetic anhydride showed the highest acetyl content and the degree of substitution (2.85 and 0.11 %). Acetylated starch with 50 g of acetic anhydride can be applied in food industry because it had low acetyl content and degree of substitution (2.15 and 0.08 %).

ACKNOWLEDGMENT

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REFERENCES

[1] Swinkels, J.J.M. (1985), "Sources of starch, its chemistry and physics" dalam Teja, A.W., Sindi, I.P., Ayucitra, A. dan Setiawan, L.E.K. (2008), "Karakteristik Pati Sagu dengan Metode Modifikasi Asetilasi dan Cross-Linking", *Teknik Kimia Indonesia*, **7** (3): 836-843.

[2] Wurzburg, O. B. (1986). Converted starches. In O. B. Wurzburg (Ed.), Modified starches: Properties and uses. Boca Raton, FL: CRC Press.

[3] Chen, L., Li, X., Li, L.,& Guo, S. (2007), "Acetylated starch-based biodegradable mate-rials with potential biomedical applications as drug delivery systems". *Current Applied Physics*, **71**: 90–93.

[4] Elomaa, M. (2004). "Determination of the degree of substitution of acetylated starch by hydrolysis,1H NMR and TGA/IR", *Carbohydrate Polymers*, **57**: 261–267.

[5] Huang, J., Schols, H., Jin, Z., Sulmann, E., & Voragen, A. G. J. (2007), "Pasting proper-ties and (chemical) fine structure of acetylated yellow pea starch is affected byacetylation reagent type and granule size", Carbohydrate Polymers, **68**: 397–406.

[6] Singh, A.V., Nath, L.K. & Guha, M. (2011), "Synthesis and Characterization of Highly Acetylated Sago Starch", *Starch-Starke*, **63**: 523–527.

[7] Mano, J. F., Koniarova, D., & Reis, R. L. (2003). Thermal Properties of Thermoplastic Starch/Synthetic Polymer Blends with Potential Biomedical Applicability. J. Matter. Sci. in Medicine, **14**, 127-135.

[8] Halal, S.L.M.E., Colussi, R., Pinto, V.Z., Bartz, J., Radunz., Carreno, N.L.V., Dias, A.R.G. dan Zavareze, E.D.R. (2015), "Structure, Morphology and Functionality of Acetylated and Oxidised Barley Starches", *Food Chemistry*, **168**: 247–256.

[9] Biswas, A., Shogren, R.L., Selling, G., Salch, J., Willett, J.L. dan Buchanan, C.M. (2008), "Rapid and Environmentally Friendly Preparation of Starch Esters", *Carbohydrate Polymers*, **74**: 137–141

Study Interpretation Phenomenon Magnetostriction and Noise of Lamination FeSi Sheets for Transformer

Mukhamad Aziz[1], Vincent Lanfranchi[2], Nicolas Buiron[3]

Abstract – One of the main problems using a transformer is the vibration and noise. This phenomenon occurs due to deformation/ magnetostriction of lamination sheets transformer core. In this research, the analysis of difference the hysteresis curve, noise and magnetostriction between the rolling direction & the transverse direction have been done. Magnetostriction was measured by gauge of deformation. Acoustic noise was measured by microphone. Magnetic saturation of the rolling direction was higher than in the transverse direction. In contrast, the magnetostriction & acoustic noise of transverse direction was higher than the rolling direction. Harmonic frequency noise measurement had similarities with harmonic frequency magnetostriction: 100, 200, 300, 400 Hz. With increasing current/voltage, the amplitude of the harmonic frequencies noise and magnetostriction will increase.

Index Terms – Magnetic flux density, magnetic field, magnetostiction, noise

INTRODUCTION

One of the main problems using a transformer is the vibration and noise [1]. This phenomenon is a result of occurs due to deformation/magnetostriction of lamination sheets transformer core. If lamination sheets deforms, vibration will occur and noise will be appear. This deformation of lamination sheet is caused by a phenomenon magnetostrive properties. It will change shape when subjected to a magnetic field. The magnetostriction is in the order of 10^{-6} in FeSi sheets, it can be source of noise in transformers [2]. Noise has relation to the magnetostriction in electromagnetic devices [3,4]. With increasing magnetic flux, deformation of magnetosriction was bigger [5]. Lungdrgren told that saturation of rolling direction is greater than the transverse direction but magnetostriction of transverse direction is greater than the rolling direction [6]. The appearance of a 180 degree (rolling direction) wall isn't followed by any magnetostriction change, but 90 degree walls are [7].

Magnetostriction λ corresponds to the dimensional variation of a sample under different induction levels. Details of the λ (B) curve can be associated with peculiar changes of the domain structure. In particular, 180° domain wall motion does not produce any dimensional change. The reverse is true for domain nucleation, 90° domain wall motion and magnetization rotation. In general, the analysis of the magnetostriction curve starts from the λ value corresponding to that inside a domain:

$$\frac{\Delta l}{l} = \left(\frac{3}{2}\right)\lambda 100\left(\alpha_1^2\beta_1^2 + \alpha_2^2\beta_2^2 + \alpha_3^2\beta_3^2 - \frac{1}{3}\right) + 3\lambda_{111}(\alpha_1\alpha_2\beta_1\beta_2 + \alpha_1\alpha_3\beta_1\beta_3 + \alpha_2\alpha_3\beta_2\beta_2) \quad (1)$$

Where the α_i and β_i are the direction cosines of the magnetization and strain measurement direction with respect to the cube axis, respectively; λ_{100} is the saturation magnetostriction (λ_s) in the [1 0 0] direction and λ_{111} is the λ_s in the [1 1 1] direction. [8]

The aim of this research is to study the phenomenon of magnetostrition and noise on rolling & transverse direction of multiple sheet FeSi Non-Grain Oriented (NGO).

METHOD

Experiment were performed on lamination sheets of non grain oriented $FeSi_{3\%}$. Samples (0,35 mm thick steel 250x250 mm sheets long rolling and transverse direction) produced by Accelor Mittal.

1) Magnetic characterization test will trace the relationship B (H) and then derive the saturation magnetization. Here, the values of quantities magnetic will be taken from oscilloscope which sampling the voltages induced by the Bcoil [2].
2) Test of magnetostriction trace the relationship between magnetic induction and magnetostriction. Here, the values of quantities magnetostriction will be taken from oscilloscope which sampling the voltages induced by gauge of deformation [3].

Noise test will trace the relationship between tension, magnetic induction and noise. Here, the values of quantities noise will be taken from oscilloscope which sampling the voltages induced by microphone.

RESULT AND DISCUSSION

Figure 3.1 shows that saturtaion of rolling direction curve (blue) slightly higher than the transverse direction (red). It is caused by the different directions of magnetic domains between the rolling and transverse direction. Difference magnetic domains direction will greatly affect the flux density (B) generated. If the magnetic domains of material has the direction of the flow of magnetic induction, the magnetic domains will not be much change direction domain. In the other hand, if the magnetic domains form angle to the direction of flow of magnetic induction, the magnetic domains should equate gradually to the direction induction.

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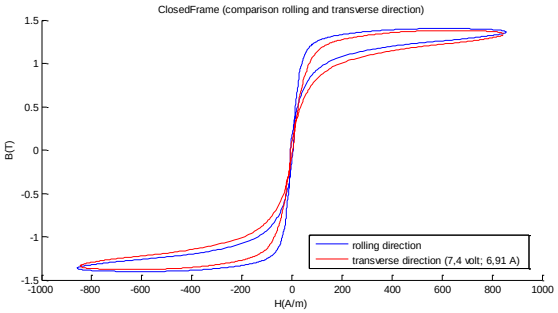

Figure 1. Comparison hysteresis curve at phase saturation: rolling direction (blue) and transverse (red) direction on voltage 7,4 volt

Figure 3.2 shows that graphic with using 7,4 volt. In top graphic, it was looked flat. It is because of starting saturation. In previous discussion, the saturation begins 7,4 volt. Like magnetic flux density, it is not much change or grow when it has reached the saturation phase, as well as magnetostriction deformation, when it reached saturation, magnetostriction deformation changing wasn't seen significant. The amplitude of magnetostriction of rolling and transverse direction are 4,35 x10^{-6} and 5,79x10^{-6} m/m.

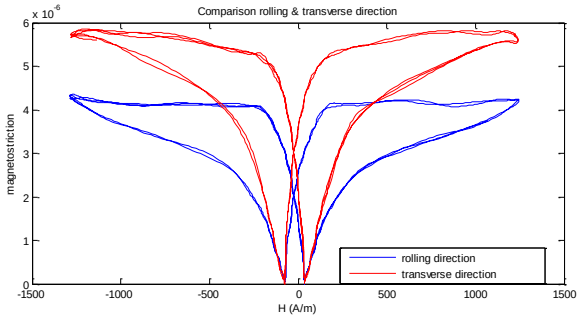

Figure 2. Comparison magnetostriction between rolling (blue) and transverse (red) direction on voltage 7,4 volt

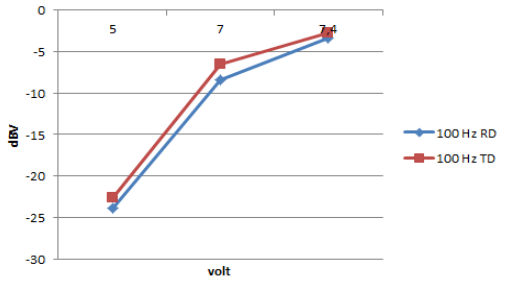

Figure 3. Comparison fft noise (dbv) rolling (blue) and transverse (red) diretion at 100 hz

CONCLUSION

Magnetic saturation of the rolling direction was higher than in the transverse direction. In contrast, the magnetostriction & acoustic noise of transverse direction was higher than the rolling direction. Harmonic frequency noise measurement had similarities with harmonic frequency magnetostriction: 100, 200, 300, 400 Hz.

REFERENCES

[1] R.S. Ming, J. Pan, "The sound-field characterisation of a power transformer", Applied Acoustics 56 257-272, 1999.

[2] S.S. Mbengue, N. Buiron, and V. Lanfranchi, "Macroscopic modeling of magnetoelastic coupling of soft ferromagnetic materials". Université de Technologie de Compiègne, 2008.

[3] O. Hubert, L. Daniel, R. Billardon," Experimental analysis of the magnetoelastic anisotropy of a non-oriented silicon iron alloy", Journal of Magnetism and Magnetic Materials 254–255, 352–354, 2003.

[4] C. Krell, N. Baumgartinger, "Relevance of multidirectional magnetostriction for the noise generation of transformer cores", Journal of Magnetism and Magnetic Materials 215-216, 634-636, 2003.

[5] S.S. Mbengue, "*Conception et caracterisation des FeSi pour transformateur*", UTC, 2012.

[6] A. Lundgren, "On measurement and modelling of 2D magnetization and Magnetostriction of SiFe sheets," Ph.D. dissertation, Royal Institute of Technology Electric Power Engineering Stockholm, 1999.

[7] H. Masui, "Influence of stress condition on initiation of magnetostriction ingrain oriented silicon steel ,"IEEE Transactions on Magnetics,vol. 31, no. 2, pp. 930-937, 1995

[8] F. Bohn, A. Gundel, F.J.G Landgraf, "Magnetostriction in non-oriented electrical steels" Physica B 384 294–296, 2006.

Aliphatic Biomaker Coal of Seram Island, Maluku Province

Jein Jelsi Lamia[1], Perry Burhan[1]

Abstract* – *Characteristic of organic geochemistry (biomarker) gives information about environment of coal. Coal was extracted by dichloromethane:methanol (93:7) for 72 h. Extract was obtained then fractionated by its polarity using column chromatography McCharty method. Subsequently, it was extracted to obtain neutral, acid and polar fractions. Neutral fraction was separated by KLTP methode and the extract were fractionated into hydrocarbon component which consist of Aliphatic and Aromatic compounds. The obtaining compounds were characterized by GCMS. Result of GCMS analyzed in Aliphatic fraction shown presence of n-alkane and derivate of terpen.These compounds are considered as important derivatives from natural products of higher plants and some compounds were expected formed by bacteria.

Index Terms* – *Biomarker, Maluku, Coal, GCMS, Organic geochemistry.

INTRODUCTION

Coal is one of the world's energy resources. Coal is an extremely complex mixture of organic chemicals containing carbon, hydrogen and oxygen as the main element, as well as sulfur and nitrogen as an additional element. The quality of coal is determined by several factors, including the presence of a basin, age and the amount of contamination. Chemical properties and the physics of a coal is determined by the mechanism of its formation (Killops and Killops, 1993)

The energy crisis prompted Indonesia to give attention to the utilization of alternative energy resources, such as coal. Maluku province has a basin that holds the potential of coal reserves in Seram Island. Geographical position of Seram island is 3 ° 13'06.2 "LS 129 ° 32'11.8" E). The discovery of coal comes from District Tehoru, Seram Island, Maluku Province. Toheru area fairly close to the District Bula is currently being explored their ground oil. This area is located in a complex tectonic zone because it is the confluence of three tectonic plates, namely: Australian Plate, Pacific Plate and the Philippines, and the Eurasian Plate. Geological activity of Seram Island affect the formation of coal in this area (Martini et all, 2003). Physically, coal sample were found in Seram is a little brown and brittle. Current data for Maluku coal reserves are estimated at 2.13 million tons (Arif, 2014)

Thermal evolution of the source rock, during diagenesis, catagenesis and metagenesis. changes many physical or chemical properties of the organic matter. These properties may be considered as indicators for maturation. Characteristics of coal Triassic period were found on the island of Seram, based on its physical properties the type of coal is immature. Formations of Seram Island are formed during the Triassic periode. Therefore, this study intend to investigate the characteristic of biomarker of coal from Seram Island. The information about the components of the building blocks of coal, source of organic material, the deposition conditions and also the time of formation of coal is expected to be clear.

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EXPERIMENTAL

A. *Method*

The Triasic coal was collected from Seram Island, Maluku Province. Sample was crushed into fine powder (120 mesh). Bitumen extraction was performed on 200 g of the powdered sample using Soxhlet apparatus with azeotropic mixture of dichloromethane (DCM) and methanol (CH_3OH) (93:7) for 72 h. Extracts Organic matters (EOM) was separated by column liquid chromatography into neutral fraction using diethyl ether (McCarthy and A.H.Duthie, 1962)

Neutral fraction was separated by Thin Layer Chromatography (TLC) with DCM into Alcohol, Ketone and Hidrocarbon fractions. Furthermore Hidrocarbon fraction was separated by Thin Layer Chromatography (TLC) with Hexane into Alifatic and Aromatic fractions.

B. *Characterizations*

Alifatic fractions have been analyzed by gas chromatography – mass spectrometry (GC-MS) agilent 122-5561 equipped with DB-5 fused capillary silica column (60 m×0.25 mm), using helium as carrier gas. The oven temperature program were 40°C (2 min hold), 40°C-100°C at 10°C/min, then 100-290°C at 4°C/min and 290°C (30 min hold). Mass spectrometry was operated 70 eV ionization voltage and 230°C interface temperature.

RESULT AND DISCUSSION

A. *Composition of hydrocarbon compounds of alifatic*

The result of GC-MS from hydrocarbon compounds of aliphatic fraction was showed at Picture 1.Fig.1.

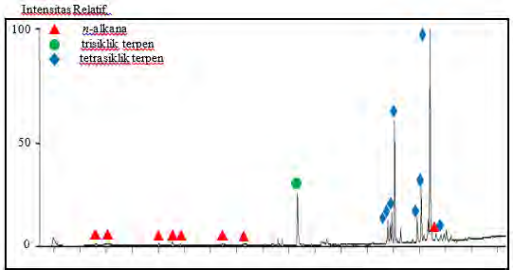

Figure 1. Chromatogram of aliphatic fraction hydrocarbon compounds of liquid coal of Seram Island, Maluku

B. n-alkane Compounds

The existence of n-alkane compounds in aliphatic fraction were identified by 57 m/z fragmentogram which was basic peak of alkane compounds. It was identified due to releasing of $(C_4H_9)^+$ groups. The fragmentogram of 57 m/z of aliphatic hydrocarbon fraction from Seram Island coal was showed at Fig. 2.

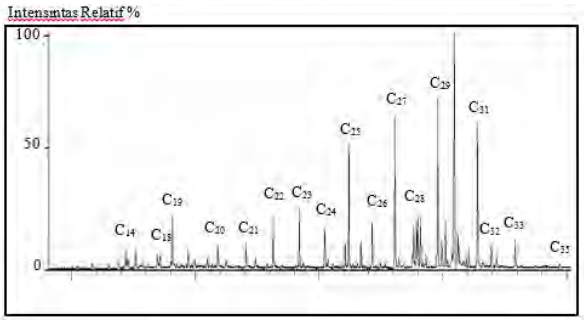

Figure 2. The fragmentogram m/z 57 of aliphatic fraction n-alkane hydrocarbon compounds of liquid coal of Seram Island, Maluku

This spectrum shows peak with characteristic pattern which linierly decreased from 57 m/z peak as base peak, furthermore the decrease peak was linierly obtained to 71; 85; 99 and etc m/z with 14 addition (as releasing methylene, $-CH_2-$) (Herod, et al., 1995).

The pattern distribution of n-alkane start from C_{14} to C_{33}, in this sample the distribution of carbon C_{14} to C_{20} less than C_{20} to C_{32}. Dominated high molecule of *n*-alkane ($>C_{20}$) gives information that the origin organic compound of sediment is from terrestrial higher plant (Erik dan Sancar, 2010). Distribution with n-alkane dominated by members in the C_{23} to C_{35} range with odd number of carbon atoms, it means that this coal still immature and reflecting a significant contributions from higher plant waxes (Killops and Killops, 1993).

C. Tricyclic and Tetracyclic Diterpenoid compounds

The partial m/z 109 and 123 fragmentograms from the aliphatic fraction of Seram Island, Maluku coal reveal the presence of tricyclic and tetracyclic terpenoid hydrocarbon. Diterpenoids can be an important source of the saturated and aromatic hydrocarbon remaining at the end of diagenesis. Trycyclic diterpenoid products can be particulary abundant where there has been a significant contribution from higher plant resins, commonly found in brown coal.

D. Hopanoids

In addition, this coal contain of 8,14-Secohopane (m/z 123 as base peak) can be formed from higher plant and other triterpenoid, the reaction appearing to be favoured by the presence of an oxygenated functional group at C-3 in the precursor. Others hopanes is 25-desmethylated hopane (m/z 177 as base peak), the presence of relatively large amounts from hopane signifying the importance of bacterial reworking, and their source beds often contain large amounts of amorphous kerogen which may derive from bacterial remains (Killops and Killops, 1993).

CONCLUSION

The aliphatic fraction of Seram Island, Maluku was identified. Among these compounds, several have been classically considered to be higher plant derived and there is bacterial activity.

REFERENCES

[1] Martini, R., Zaninneti, L., Lathuilliere, B., Cirilic, S., Cornee, J. dan Villeneuve, M. (2003), "Upper Triasic Carbonate Deposit of Seram (Indonesia): Palaeogeographic and Geodynamic Implications", *Palaeo*, Vol. 206, hal. 75-102.

[2] S.D Killops and V.JKillops "An Introduction to Organik Geochemistry". *Longman Scientific & Technical, New York*. 1993

[3] Arif. "Batubara Indonesia". Jakarta. PT. Gramedia Pustaka Utama. 2014.

[4] R.D McCarthy and A.H.Duthie. "A Rapid Quantitative Method for The Separation of Free FattyA from Other Lipids", *Journal Lipid Research, 3*. 1962.

[5] Herod, A. A., Hellenbrand, R., Xu, B., Zhang, S., & Kandiyoti, R. (1995). Alkanes and solvent dimers in successive extract fractions released from coal during liquefaction in a flowing-solvent reactor. *Fuel*, *74*(12), 1739-1752.

Effect of Phosphotungstic Acid toward Composite Membrane for DMFC Application

Sri Endang Suharini[1], Dian Permana[1] Lukman Atmaja[1]

Abstract – Fuel cell consists of an electrolyte, which connected to the anode and cathode through a polyelectrolyte membrane in which the membrane is capable of delivering protons from the anode toward the cathode. The aim of this study is to know the effect of acid on the membrane composite phosphotungstic chitosan/montmorillonite-silane 10% of the ion exchange capacity, proton conductivity and methanol permeability using a variation of the 0; 0.5; 1.0; 1.5%, respectively. The additions of phosphotungstic acid increased the proton conductivity and ion exchange capacity. However, in this study, the highest proton conductivity on chitosan/ montmorillonite-silane 10%/1.0% phosphotungstic acid caused by a strong hydrophilic nature phosphotungstic acid.

Index Terms – Membrane, Methanol Permeability, Proton Conductivity and Ion Exchange Capacity.

INTRODUCTION

Fuel cells are electrochemical devices that convert chemical energy of reactants directly into electricity and heat with high efficiency. DMFC is one of the fuel cells used that is the liaison between the reaction at the cathode and anode through a membrane [1]. At this time, the membrane is widely used Nafion© which has high proton conductivity and good chemical stability but it is expensive. Therefore, alternative membrane is required to other materials that have a high conductivity at a cheaper price [2].

Heteropoly acid is one of donor proton conductivity and good thermal stability include phosphomolibdate acid (PMA), silicotungstic acid (Shiva), and phosphotungstic acid (PWA). Phospotungstic acid has been known as an inorganic material which acts as a proton conductor super ionic in type-Keggin HPA, which has a proton conductivity, value of 0.02 to 0.1 S/cm at room temperature [3]. In this study, DMFC membrane made of chitosan and mixing chitosan (CS) as a matrix and montmorillonite (MMT) modified by silane 10% as filler that both added additives phosphotungstic acid at 0; 0.5; 1.0 and 1.5%. The aim of this research is to study the applicability of this polyelectrolyte complex - a composite membrane, for DMFC by analysis Proton Conductivity vs. Ion Exchange Capacity.

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EXPERIMENTAL

A. Synthesis of CS/PWA and CS/MMT-Silan/PWA Membranes

2 g 2.0 wt.% Aqueous solution of acetic acid equally divided by into two portions. (i) 1 g CS powders were dissloved in one portion of acetic acid solution at 60-70ºC, (ii) 0,9 g CS powders were dissolved in one portion of acetic acid solution at 60-70ºC, a certain amount of montmorillonite was dispersed in the portion of acetic acid solution by ultrasonic treatment for 30 min. Subsequently, two portions of solution were mixed, and stirred at 60-70ºC for 30 min. Then, ultrasonic treatment and stirring carried out alternatively, each for 30 min. After thorough degasification, the mixture cast onto clean glass plate and dried at room temperature for 10-15 days. The neutralized membranes were washed several times with deionized water and soaked in PWA solution 0; 0, 5; 1,0 and 1,5% for 24 h. Then, the membranes washed and immersed in deionized water for 24 h to remove the physically absorbed PWA. Finally, the membranes dried at 25ºC. The membranes were denoted as CS/PWA (0; 0,5; 1,0; 1,5%) and CS/MMT-Silan 10%/PWA (0; 0,5; 1,0; 1,5%).

B. Characterizations

Proton conductivity using Impedance Analyzer, methanol permeability using density method, and ion exchange capacity using classical titration.

RESULT AND DISCUSSION

A. Proton conductivity, methanol permeability and ion exchange capacity

Proton conductivity of membranes was determined by means of the complex impedance method. All impedances were carried out after hydration of the membranes. The result clearly seen that adding PWA into chitosan increased the proton conductivity. In table 1, the best composition was obtained for CS/PWA 1,5% of 0,0033 S/cm at 60ºC and CS/MMT-Silan 10%/PWA 1,0% of 7,90 x 10^{-5} S/cm at 80ºC.

The methanol permeability decreased as increasing concentration of phospotungstate acid which added to modified chitosan. It is indicated that PWA was taken place in membrane to improve the methanol rejecting. The lower methanol permeability was obtained in CS/MMT-Silan 10%/PWA 1,0% of 1,15 x 10^{-6} cm^2/s. Ion exchange capacity (IEC) indicates the density of ionizable hydrofilic functional groups in the membrane and was determined by the classical titration. In table 1,the biggest of ion exchange capacity of CS/PWA 1,0% is 5,10 meq/g while modification membrane (CS/MMT-Silan 10%/PWA 1,0%) is 4,78 meq/g. This proves adding PWA into

chitosan indicates many density of ionizable hydrofilic functional groups in the membrane.

Table 1. Proton Conductivity, Methanol Permeability and Ion Exchange Capacity of CS/PWA and CS/MMT-Silan 10%/PWA.

Membrane	σ (x 10^{-3} S/cm) (60ºC)	P (x 10^{-6} cm^2/s)	IEC (meq/g)
CS/PWA 0%	1,1	2,29	0,81
CS/PWA 0,5%	2,86	1,72	3,77
CS/PWA 1,0%	3,08	2,87	5,10
CS/PWA 1,5%	3,30	3,44	4,62
CS/MMT-Silan 10%/PWA 0%	0,0582	3,44	0,85
CS/MMT-Silan 10%/PWA 0,5%	0,064	4,59	1,21
CS/MMT-Silan 10%/PWA 1,0%	0,070	1,15	4,78
CS/MMT-Silan 10%/PWA 1,5%	0,063	1,72	3,39

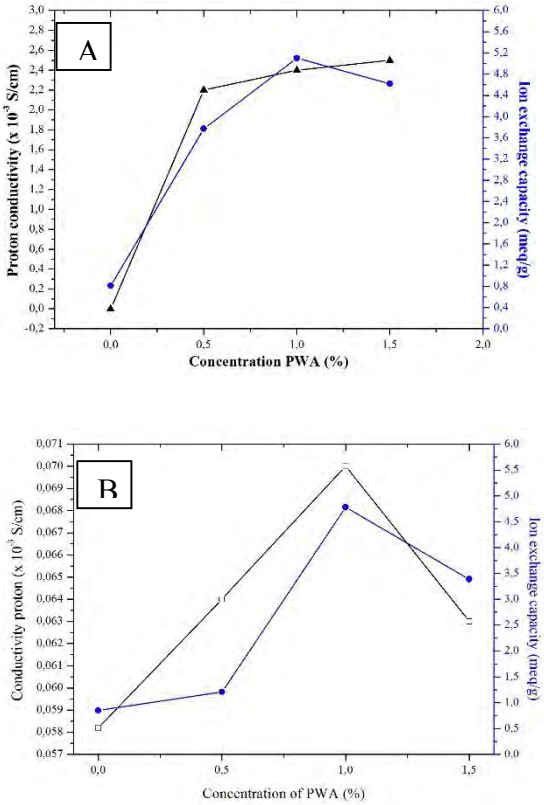

Figure 1. The proton conductivity vs ion exchange capacity of membrane (a) cs/pwa and (b) cs/mmt-silan 10%/pwa.

Figure 1 shows correlation between increasing concentration of PWA, conductivity and ion exchange capacity. It obtained that increasing concentration of PWA increased proton conductivity and ion exchange capacity.

CONCLUSION

In conclusion, increasing concentration of PWA lead to increase proton conductivity and ion exchange capacity. The best composition of membrane obtained in CS/PWA 1,5% and CS/MMT-Silan/PWA 1.0%.

ACKNOWLEDGEMENTS

The first author is thankful to Direktorat Jenderal Pendidikan Tinggi (DIKTI) for their post-graduate scholarship. We thank Dr. Bambang Prijamboedi for his help in the proton conductivity measurements.

REFERENCES

[1] Spiegel, C.S., Designing & Building Fuel Cells. The McGraw-Hill Companies. United States of America, 2007.

[2] Jiang Z., Hong Wu. Zheng B., Zheng X., Wang J., Yuan W, "Surface-modified Y zeolite-filled chitosan membrane for direct methanol fuel cell", *Journal of Power Sources,* Vol. 173, pp. 842-852, 2007.

[3] Cui, Z., Xing, W., Liu, C., Liou, J., Zhang, H.,"Chitosan/heteropolyacid composite membranes for direct methanol fuel cell", *Journal of Power Sources,* Vol. 188, pp. 24-29, 2009

Effect of Calcium Carbonate as Filler at the Chitosan/Calcium Carbonate Composite Membrane

Retno Rahayu Dinararum[1], Dian Permana[1] Lukman Atmaja[1]

Abstract – Membrane is the most important part of Direct Methanol Fuel Cell (DMFC) because of its function as a proton transfer. The purpose of this research was studying the effect of calcium carbonate filler to the performance of chitosan (CS)/Calcium Carbonate (CC) composite membrane using 0.02; 0.04; 0.06; 0.08; and 0.10 g of CC. In this study, CS/CC membranes showed high performance for DMFC application. The best concentration of CS/CC was obtained with 0.06 g of CC based on proton conductivity, methanol permeability, and TGA measurements.

Index Terms – Chitosan, calcium carbonate, DMFC, thermal stability.

INTRODUCTION

Main sources of energy are from coal and petroleum, which were a natural source that cannot be re-newable because it comes from fossils. Using it continuously without product efficiency, new research discovery, or change to other energy sources can lead to scarcity of energy, causing great influence on humanity, and also produce harmful pollutants, like CO_2 [1].

Many researches have focused on using fuel cells due to its product reactions, water, which is eco-friendly and capable to convert chemical energy to electrical energy with good efficiency. Five types of fuel cells are distinguished by the type of electrolyte, PEMFC, AFC, SOFC, PAFC, and MCFC. Among this five, PEMFC become one of the most widely recommended as an alternative energy source due to easy operation, low operating temperature, and high density [2]. The fuel that commonly used in PEMFC is methanol, and then called as DMFC (Direct Methanol Fuel Cell).

Component of DMFC is anode (oxidation reaction), cathode (reduction reaction), and membrane. Membrane was not only tribute to separate cathode and anode, but also to transfer protons [3]. Good membrane has to have high proton conductivity and thermal stability, and low methanol permeability [4]. Commercial membranes have been widely studied for DMFC is Nafion®. Nafion® is perfluorosulfonat acid-based membrane that has high chemical stability and proton conductivity. But it has high methanol permeability and expensive due to complicated production process. High methanol permeability not only reduces fuel efficiency and performance, but also reduces the performance of cathode [4-5].

Chitosan (CS) is a natural biopolymer with a unique character as a biocompatible, non-toxic, good chemical and thermal stability, and low methanol permeability. Chitosan can be obtained from chitin, a polysaccharide that contains N-acetyl-D-glucosamine [4]. Proton conductivity of CS membrane lowers than Nafion®. Because of that, CS needs to be modified to improve membrane performance [2]. The existence of inorganic materials plays important role in rejecting methanol. Use Calcium Carbonate (CC) as filler has made a significant contribution. The effect of CC on a CS membrane could improve thermal properties based on the TGA results [6].

In this study, CS will be used as the matrix polymer, CC as filler in various concentrations (0.02; 0.04; 0.06; 0.08; and 0.10 g), and sulfuric acid as a crosslink agent. Hopefully, the interaction between hydrophilic CS with hydrophobic CC can improve properties of the membrane for DMFC application. Properties and performance of CS and CS/CC membranes will be characterized by Thermogravimety Analysis (TGA), analysis of proton conductivity and methanol permeability.

EXPERIMENTAL

A. Synthesis of CS/Calcium carbonate membranes

2.0 g of CS powder and CC in various concentration (0.02; 0.04; 0.06; 0.08 and 0.10 g) dissolved in 80 ml and 20 ml of acetic acid solution 2% (at 65°C). CC solution dissolved by ultrasonic treatment for 30 min. Subsequently, two portions of solution were mixed, and stirred at 65°C for 30 min, then treated by sonication for 30 min. The resulting viscous solution was cast onto a flat dry glass plate and dried at room temperature for 72 h. The resulting membrane subsequently neutralized using 1N of NaOH solution, washed by demineralized water, and dried at room temperature. Furthermore, the membrane was soaked by 2M of sulfuric acid solution (cross-link process) for 24 h, soaked with demineralized water for 24 h, and finally dried at room temperature. The thickness of all membranes was 1.5×10^{-2} cm. The membranes were denoted as CS, CS/CC1, CS/CC2, CS/CC3, CS/CC4 and CS/CC5.

B. Characterizations

All membranes were characterized with Mettler Toledo Thermal Gravimetry Analysis (TGA) and analyzed for its proton conductivity and methanol permeability.

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RESULT AND DISCUSSION

A. Thermal property

Good membrane can be analyzed by its thermal stability. Higher thermal stability is required to guarantee a long lifetime of PEMs in DMFCs. According to TGA results in Fig. 1, increasing CC concentration significantly could increase the thermal stability of the CS/CC.

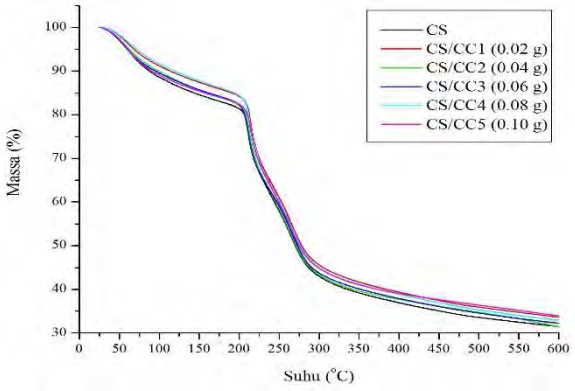


Figure 1. TGA curves of CS and CS/CC membranes.

B. Proton conductivity and methanol permeability

Proton conductivity of CS and CS/CC membranes was determined by impedance method. All impedances were carried out after hydration process of the membranes. The results clearly seen that adding CC into CS increased the proton conductivity at temperature 40-60°C.

Table 1. Proton conductivity (σ) and methanol permeability (p) of CS and CS/CC membranes.

Code	σ (25°C) (S/cm)	σ (40°C) (S/cm)	σ (60°C) (S/cm)	P (x 10^{-6} cm^2/s)
CS	$1.83x10^{-4}$	-	-	3.44
CS/CC1	$1.06x10^{-4}$	$5.32x10^{-5}$	$6.92x10^{-5}$	3.01
CS/CC2	$1.60x10^{-4}$	$6.38x10^{-5}$	$7.45x10^{-5}$	2.58
CS/CC3	$1.70x10^{-4}$	$7.02x10^{-5}$	$8.03x10^{-5}$	1.96
CS/CC4	$1.42x10^{-4}$	$5.85x10^{-5}$	$6.44x10^{-5}$	2.82
CS/CC5	$1.18x10^{-4}$	$5.36x10^{-5}$	$5.76x10^{-5}$	3.30

Modifying CC into CS membrane give other effect in methanol permeability, that decreased as much as concentration of CC. It is indicated that CC has hydrophobic parts that could improve the ability of membrane to reject methanol. The result of proton conductivity and methanol permeability shows in Tab. 1. The best composition of composite membrane was obtained in CS/CC3 (0.06 g) with $8.03x10^{-5}$ S/cm and $1.96x10^{-6}$ cm^2/s for proton conductivity and methanol permeability.

CONCLUSION

In conclusion, the increase of calcium carbonate concentration from 0.02 to 0.10 g causing the increase of thermal properties, proton conductivity and decrease methanol permeability. The best composition of membrane was obtained in CS/CC3 (0.06 g) with the highest proton conductivity and lowest methanol permeability. Proton conductivity of CS/CC membrane is bigger than unmodified CS membrane when treated at high temperature, either do methanol permeability. This result implies that this composite membrane is a good candidate for DMFC in fuel cell application.

ACKNOWLEDGEMENTS

The first author is thankful to Direktorat Jenderal Pendidikan Tinggi (DIKTI) for their post-graduate scholarship. We thank Dr. Bambang Prijamboedi for his help in the proton conductivity measurements.

REFERENCES

[1] U. Lucia, "Overview on Fuel Cells", Renewable and Sustainable Energy Reviews, vol. 30, pp. 164-169, Oct 2013.

[2] Y. Wang, K.S. Chen, J. Mishler, S.C. Cho, X.C. Adroher, "A Review of Polymer Electrolyte Membrane Fuel cells: Technology, Applications, and Needs on Fundamental Research", Applied Energy, Vol. 88, pp. 981-1007, Sept 2010.

[3] Z. Cui, W. Xing, C. Liu, J. Liao, H. Zhang, "Chitosan/Heteropolyacid Composite Membrane for Direct Methanol Fuel Cell", J. Power Sources, Vol. 188, pp. 24-29, Dec 2008.

[4] M. Rikukawa, K. Sanui, "Proton-conducting Polymer Electrolyte Membranes Based on Hydrocarbon Polymers", Prog. Polymer Science, Vol. 25, pp. 1463-1502, Jul 2000.

[5] M.I. Ahmad, S.M.J. Zaidi, S.U. Rahman, "Proton Conductivity of Novel Composite Membranes for Medium-temperature Fuel Cell", Desalination, Vol. 193, pp. 387-397, Jun 2005.

[6] S.K. Swain, S. Dash, S.K. Kisku, R.K. Singh, "Thermal and Oxygen Barrier Properties of Chitosan Bionanocomposites by Reinforcement of Calcium Carbonate Nanopowder", J. Material Science Technology, Vol 30(5), pp. 791-795, Jan 2014

Isolation of Antioxidant Compounds from *Mangiferaindica* L. Leaves

Fitria[1], Sri Fatmawati[1], Taslim Ersam[1]

Abstract – The free radical scavenging activity of Mangiferaindica L. Leaves had been performed. The methanol extract showed the highest 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS) free radical scavenging activity among other extracts. Bioassay guided fractionation was performed and yielded three isolated compounds. Their structures were identified as mangiferin (1), friedelin (2) and lupeol (3). Mangiferin exhibited free radical scavenging activity, with an IC_{50} value of 12.12 µg/mL in vitro.

Index Terms – Free radical scavenging, Mangifera indica L. Leaves., ABTS.

INTRODUCTION

Mangiferaindica L., known as mango, is the fruit tree belonging to the Anacardiaceae family. Mango is widely distributed in many tropical and sub-tropical regions of the world, including the countries of Indonesia, India, Thailand and China [1]. The previous investigation of *M. indica*L**.** Chemical composition had been reported the presence of triterpenoids [2], phenolic compounds [3], and diarylheptanoid compounds [4]. The crude extract from the seed kernels of *M. indica*L showed antibacterialactivity [5] and antioxidant activity [6] while that of the peels displayed anti-inflammatory activity [7].

The aim of present study were to isolate and identify antioxidant compounds from methanol extract of *M. mangifera*L leaves. The compounds were identified by NMR spectroscopy. The antioxidant activity from four different extracts of *M. indica* L**.** and isolated compounds had also been studied. To the best of our knowledge, this is the first report on ABTS free radical scavenging activity of extracts and isolated compound of *M. mangifera*L leaves.

EXPERIMENTAL

A. Extraction and Isolation

The leaves of *M. indica* L. (650 g) were extracted with methanol (10 L) for 3 days at room temperature. The extracts were concentrated by vacuum rotary evaporator which resultedthe dark brown crude extract. The crude extract was suspended in 50 mL of 50% methanol then partitioned with 100 mL dichloromethane for 4 times.

The aqueous methanolic fraction was hydrolysed by reflux with 2 N sulphuric acid at pH 3 for an hour with continuous stirring. After cooled at room temperature, it was partitioned with 100 mL ethyl acetate for 3 times. Subsequently, the combined ethyl acetate layer was dried using a vacuum rotary evaporator. The dried ethyl acetate fraction was dissolved in methanol and left in a refrigerator (4-8°C) over night, then the filtration was done to produce compound **1**.

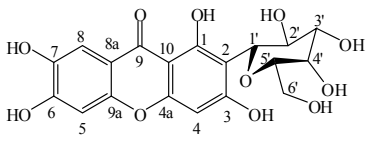
The dichloromethane phase was evaporated by rotary evaporator vacuum. The dichloromethane fraction residue was subjected to column chromatography to produce compound **2**(*n*-hexane-dichloromethane from 100:0 to3:7 as elute). Fraction D was subjected to column chromatography to give compound **3** (*n*-hexane- dichloromethane from 8:2 to 1:9 as elute).

B. 2,2'-Azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) (ABTS) free radical scavenging activity

Radical scavenging activity was validated by the UV absorbing method. Various concentration of sample were prepared by dissolving sample (10 mg) in DMSO (1 mL). The sample solution (10 µL) were added ABTS solution (1 mL). After 4-min incubation at 30°C, the absorbance of the resulting solution was measured at 734 nm with spectrophotometer.

RESULT AND DISCUSSION

The four different extracts of M.indica L. leaves and three isolated compounds were subjected to examination for potential free radical scavenging on ABTS. The results were summarized in Fig 1. Methanol extract showedthe highest antioxidant activity than that of other extracts, with IC50 value of 3,18 µg/mL.The abundant bioactive compounds plays an important role in antioxidant activity. Methanol extract includes many secondary metabolic compounds as flavonoid, saponin, tannin, steroid [8]. Based on the results, the methanol extract was further fractionated and yielded three compounds.



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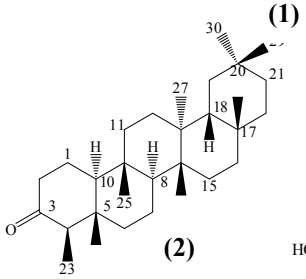

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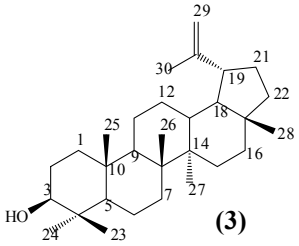

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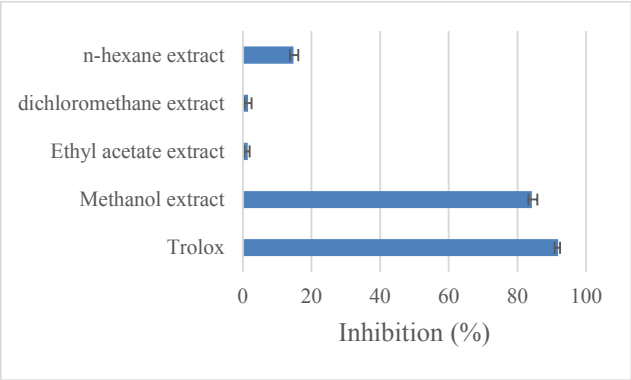

Figure 1. ABTS free radical scavenging activities of four *Mangiferaindica* L. Leaves extracts. All results presented as means ± standard deviations of three replicated determinations. Trolox as was a reference antioxidant.

The chemical structure elucidation of isolated compounds was then performed by using NMR data. The isolated compounds are identified asMangiferin (**1**), friedelin (**2**) and lupeol (**3**). The NMR data were accorded with the literature value of mangiferin [4], friedelin [2] and lupeol [2].

Mangiferin had higher ABTS free radical scavenging than that of compound 2 and 3. Mangiferin showed antioxidant activity with IC_{50} value of 12.12 µg/mL.Mangiferin is the xanthone derivative that has ortho-protected catechol. These result suggested that presence of the ortho-dihydroxy groups at C-6 and C-7 on ring B of xanthones might be involved in the enhanced antioxidant activity. The xanthones with catechol groups can be donating hydrogen radical and give a higher stability to their radical form [9]. The compound 2 and 3 showed low activity, with IC_{50}> 49.50 µg/mL.

CONCLUSION

In the present study, the antioxidant compounds were isolated from methanol extract of*M. indica*L.leaves. Mangiferin showed the highest ABTS free radical scavenging activity which can be developed as antioxidant source.

REFERENCES

[1] Schieber, A (2007), "Mango (Mangiferaindica L, a 'functional fruit'?,fruit processing, 17(3), 149-152.

[2] Anjaneyulu, V., Radhika, R., (2000), "The triterpenoid from *Mangiferaindica*linn", Review, Indian Journal of Chemistry, 39B, 883-893.

[3] SellésNũñéz, A. J., Vélez Castro, H. T., Agüero- Agüero, J., González- González, J., Naddeo, F., De Simonne, F., Rastrelli, L., (2002), " Isolation and Quantitative Analysis of Phenolic Antioxidants, Free Sugar, and Polyols from Mango (*Mangiferaindica* L.) Stem Bark Aqueous Decoction Used in Cuba as a Nutritional Supplement", Journal of Agricultur and Food Chemistry, 50, 762-766.

[4] Xiao-xia, Y., Yue, X., Zu-jiang, X., Guo-cheng, L., (2013), "A New Diarylheptanoid from Bark of *Mangiferaindica*", Chinese Herbal Medicines, 5 (4), 320-322.

[5] Doughari, J. H., Manzara, S., (2008), "In vitro Antibacterial Activity of Crude Leaf Extract of *Mangiferaindica* Linn", African Journal of Microbilogy Research, 2, 067-072.

[6] Pitchoan, M., (2011), "Antioxidant Capacity of Extracts and Fraction from Mango (*Mangiferaindica* Linn.) Seed Kernels", International Food Research Journal, 18, 523-528.

[7] Knodler, M., Conrad, J., Wenzig, E. M., Bauer, R., Lacorn, M., Beifuss, U., Carle, R., Schieber, A., (2008), "Anti-inflammatory 5-(11'Z-heptadecenyl)- and 5-(8'Z, 11'Z-heptadecadienyl)-resorcinol from mango (*Mangiferaindica* L) peels", Phytocemistry, 69, 988-993.

[8] Aiyelaagbe, O. O., Osamudiamen, P. M., (2009), "Phytochemical Screening for Active Compounds in *Mangiferaindica* Leaves from Ibadan, Oya State", Plant Sciences Research, 2 (1), 11-13.

[9] Mahabusarakum, W., Nvangnaowarat, W., Taylor, W.C., (2006), "Xanthonesderivates from Cratoxylumcochinchinense", phytochemistry, 50, 471-476

Organic Geochemistry Studies Aliphatic Fraction Bontang Coal, East Kalimantan

Titik Andriani[1], R. Y. Perry Burhan[1]

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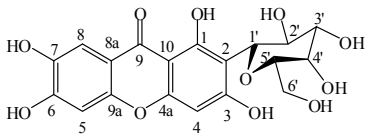

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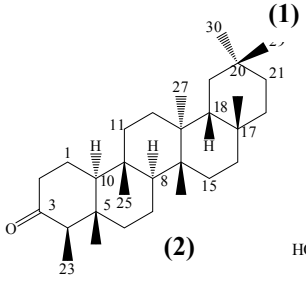

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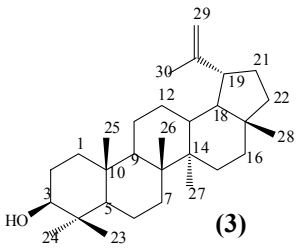

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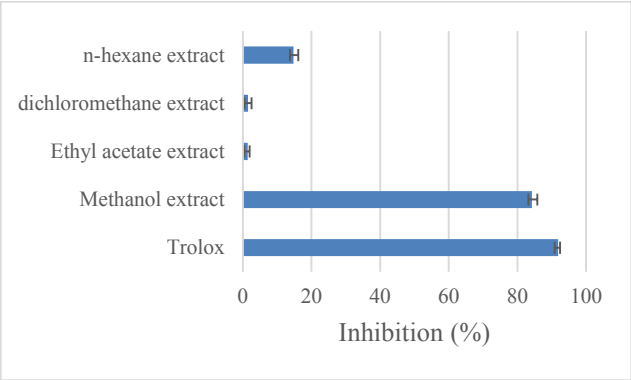

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[1] Schieber, A (2007), "Mango (Mangiferaindica L, a 'functional fruit'?,fruit processing, 17(3), 149-152.

[2] Anjaneyulu, V., Radhika, R., (2000), "The triterpenoid from *Mangiferaindica*linn", Review, Indian Journal of Chemistry, 39B, 883-893.

[3] SellésNũñéz, A. J., Vélez Castro, H. T., Agüero- Agüero, J., González- González, J., Naddeo, F., De Simonne, F., Rastrelli, L., (2002), " Isolation and Quantitative Analysis of Phenolic Antioxidants, Free Sugar, and Polyols from Mango (*Mangiferaindica* L.) Stem Bark Aqueous Decoction Used in Cuba as a Nutritional Supplement", Journal of Agricultur and Food Chemistry, 50, 762-766.

[4] Xiao-xia, Y., Yue, X., Zu-jiang, X., Guo-cheng, L., (2013), "A New Diarylheptanoid from Bark of *Mangiferaindica*", Chinese Herbal Medicines, 5 (4), 320-322.

[5] Doughari, J. H., Manzara, S., (2008), "In vitro Antibacterial Activity of Crude Leaf Extract of *Mangiferaindica* Linn", African Journal of Microbilogy Research, 2, 067-072.

[6] Pitchoan, M., (2011), "Antioxidant Capacity of Extracts and Fraction from Mango (*Mangiferaindica* Linn.) Seed Kernels", International Food Research Journal, 18, 523-528.

[7] Knodler, M., Conrad, J., Wenzig, E. M., Bauer, R., Lacorn, M., Beifuss, U., Carle, R., Schieber, A., (2008), "Anti-inflammatory 5-(11'Z-heptadecenyl)- and 5-(8'Z, 11'Z-heptadecadienyl)-resorcinol from mango (*Mangiferaindica* L) peels", Phytocemistry, 69, 988-993.

[8] Aiyelaagbe, O. O., Osamudiamen, P. M., (2009), "Phytochemical Screening for Active Compounds in *Mangiferaindica* Leaves from Ibadan, Oya State", Plant Sciences Research, 2 (1), 11-13.

[9] Mahabusarakum, W., Nvangnaowarat, W., Taylor, W.C., (2006), "Xanthonesderivates from Cratoxylumcochinchinense", phytochemistry, 50, 471-476

Design Of Temperature Measurement System On The Drying Process Of Madura Tobacco Leaves

Humadillah Kurniadi Wardana[1], Endarko[1]

Abstract – The quality of dried chopped leaves of tobacco is an important factor. The present work developed an oven for drying process to measure and evalute on drying shrinkage characteristic of choped leaves Madura tobacco. The oven has three racks for analyzing and monitoring the rate of drying shrinkage of Madura tobacco. Every rack has a different amount of chopped leaves as follows: 120 g on top rack, 100 g for middle rack and 80 g for bottom rack. Rate of drying shrinkage was analyzed for 20 minutes. The results showed that every rack has different rate of drying shrinkage for drying time. The rate of drying shrinkage was achieved at 26-35% for all racks with temperature distribution in oven at 25 – 30 ℃.

Index Terms – Measurement, temperature, drying, shrinkage, chopped tobacco.

INTRODUCTION

Post-harvest handling, drying is an important stage to maintain quality of Madura chopped tobacco in accordance with the SNI 01-3942-1995. The drying process is a process of evaporation or decreased water content of a material so that the water levels reach equilibrium at normal temperature [1].

Tobacco leaf processing is the process of drying wet leaves become dry leaves (krosok or chopped). Meanwhile the chopped leaves of tobacco with colored dark, the drying process is done in a few days accompanied by of condensation process until the desired color [2].

Main problems in countryside for drying process of chopped leaves of tobacco is still using conventional method. The process depends on the presence of sunlight[3]. The weakness of traditional drying that still rely sunlight among requires a relatively long time and are very dependent on weather conditions so that the drying to be carried out cannot run optimally. Require large place to perform drying.

This research aims to create a drying sistem of chopped leaves of tobacco using a dryer rack type which utilizes heat energy from a tubular heater. The distribution of temperature, mouisture, drying rate, as well as process heat transfer to the system to be measured and analyzed.

METHOD

Chopped leaves of Madura tobacco as samples was used to determine characterization on drying shrinkage. 300 g of chopped leaves of Madura tobacco was divided into three racks as follows: 120 g on top rack, 100 g for middle rack and 80 g for bottom rack.

A tubular heater with output power of 600 W was used for heat supply in the oven. Blower in combination with fan blades which can set the speed of wind was used to ensure homogeneous of temperature distribution inside oven. Digital thermometer with type K thermocouple to measure and monitor temperature distribution inside oven. Anemometer for measuring wind speed from blower.

Figure 1 is a phase of testing and data collection is done in this study whereas the temperature measurement points shown in Figure 2. In the first rak, temperature measurements carried out at three different points, namely the position *d* (T_1), the position *a* (T_2), and the position *c* (T_3). Temperature measurement on the second shelf is done in three different points, namely the position c for T_1, the position *d* for T_2, and the position *b* for T_3. Meanwhile the temperature measurement on the third shelf is done in three different points, namely T_1 for the position *d*, T_2 for the position *b*, and T_3 for the position *a*. The temperature on the heat source is measured at the point of Tp.

Heating source is turned ON for 20 minutes at a flow rate 0.5 m/s with a blower voltage of 50 V. Changes in temperature are recorded every 5 minutes until the drying time is completed.

Moisture samples of chopped leaves of tobacco (K_{at}) can be calculated using equation as follows.

$$Kat = \frac{mb-mk}{mb} \times 100 \quad (1)$$

Hereinafter, the drying rate (v) of chopped leaves of tobacco can be calculated with equation:

$$v = \frac{mb-mk}{t} \quad (2)$$

In general, the heat transfer rate can be expressed with Newton's law of cooling as follows:

$$q_{kv} = h_{kv}\, A\, (T_b - T_f) \quad (3)$$

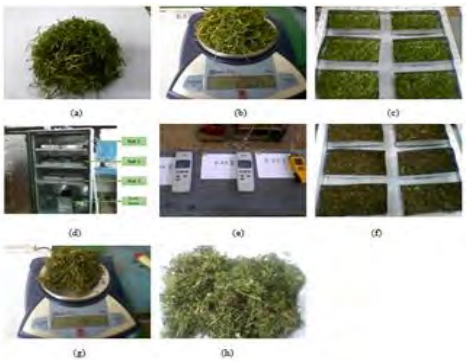

Figure 1. Testing phase and data colection

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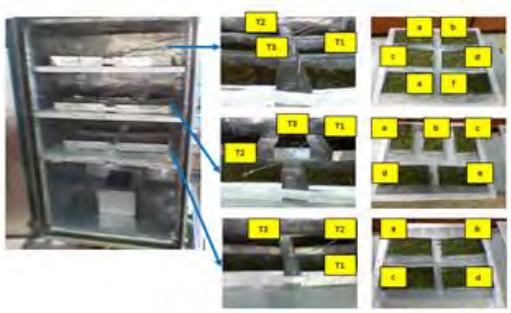

Figure 2. The points of measurement Temperature distribution.

RESULT AND DISCUSSION

Madura chopped tobacco drying process in this study lasted 20 minutes. Changes in temperature against time on testing are presented in Table 1.

Table 1. Results of Temperature Distribution in Space Dryer with Rack Mounted and Tobacco Ingredients Sliced for 20 Minutes

Information	Temperature Reached (°C)	The Highest Temperature (°C)	The Lowest Temperature (°C)
Heating Source	27,7-44,8	-	-
Temperature Out	30-31,2	-	-
Rack 1	25,8-28,4	a (26,5-28,4)	d (25,8-27,5)
Rack 2	26-28,8	c (26,1-28,8)	d(26-28)
Rack 3	26,2-30,3	a (26,8-30,3)	d(26,2-29,1)

Using equation 1 can be obtained percentage decline in the value of the water content in table 2.

Table 2. Results Percentage Decrease in Water Levels for 20 Minutes

Water Content	Percentage Decrese (%)	The Highest Percentage (%)	The Lowest Percentage (%)
Rack 1	27-34,5	a (34,5)	c (27)
Rack 2	26-32	b (32)	d&e(26)
Rack 3	29-35	a (35)	d(29)

Drying rate calculation using equation 2. Graphics drying rate for 20 minutes is shown in Table 3.

Table 3. Results The rate of drying Sliced Tobacco Ingredients for 20 Minutes

Information	Drying Rate Achieved (g/minute)	The Highest Rate of Drying (g/minute)	The Lowest Rate of Drying (g/minute)
Rack 1	0,27-0,35	a (0,35)	c (0,27)
Rack 2	0,26-0,32	b (0,32)	d&e(0,26)
Rack 3	0,29-0,35	c&d (0,35)	d(0,29)

To calculate the heat transfer rate received by each shelf using equation (3).

Table 4. Heat transfer on Shelf 1

T1	T2	T3	Q1(J)	Q2(J)	Q3(J)
25.8	26.5	26.5	0.00	0.00	0.00
26.6	27.2	27.2	5.09	4.04	4.04
27.1	27.5	27.5	7.50	5.77	5.77
27.2	27.9	27.9	8.08	8.08	8.08
27.5	28.4	28.3	9.81	10.97	10.97

CONCLUSION

Drying conducted for 20 minutes shows temperature distribution in the drying chamber 25-30 °C with a reduced water content 26-35% and the drying rate from 0.26 to 0.35 (g / min) and the heat energy of 0-20, 20 A. For the SNI test results obtained dryness level of 12.83%, while blackish green color characteristic elasticity (handle) obtained information rather sociable.

REFERENCES

[1] Henderson, SW and R.L Perry, *Agricultural Process Engineering*, 3rd Ed Avi Publ.Co.Inc Westport, Conecticut, 1982.

[2] Joko, Hartono, "Variasi dan Perbaikan Cara Pengolahan Berbagai Tipe Tembakau Rajangan di Berbagai Wilayah Penghasil Tembakau," *Perspektif*, ISSN: 1412-8004, 2013.

Synthesis of Polymeric Membrane for Desalination Process

I Made Pendi Adi Merta[1], Deffry Danius Dwi Putra[1], Siti Nurkhamidah[1], Yeni Rahmawati[1], Fadlilatul Taufany[1]

***Abstract* – Cellulose acetate/polyethylene glycol 200 (CA/PEG) membrane with ration 80/20 (wt%) was modified with varying amount of silica in many concentration (1-5% w/v). CA/PEG-200 membranes were characterized for their hydrophilicity, functional groups and permeation properties. The increasing of CA at CA/PEG membrane make membrane more dense and hydrophilicity of membrane decreases. Membrane hydrophilicity, permeate flux, permeability, and salt rejection increase with the increasing of silica concentration in CA/PEG membrane. The experiment results show that the highest salt rejection was obtained when 5% silica was added into CA/PEG (80/20) membrane.**

***Index Terms* – Cellulose acetate, desalination polyethylene glycol, silica.**

INTRODUCTION

Water is one of the most important needs for human being. There is only 2.5% of fresh water which can be use directly without processing it first and the rest of them are salt water. Membrane is one of the most innovative technologies for desalination process.

An ideal desalination membrane should possess the resistance of chemical attack, separation process, good mechanical and thermal stability. Several of polymers have been used to synthesize membranes but Celluloce Acetate (CA) membranes were well accepted. However, CA is vulnerable to fouling resistance. Many substance had been investigated the effect of addition to CA membrane. The effect of PEG had been reported to increase porosity and flux upon decreasing molecular weight of PEG [2]. The effect of silica had been reported to increase salt rejection, thermal stability, and flux upon increasing amount of silica in membrane [1].

In this paper, a detailed study of membrane synthesizing is reported. These membranes were prepared by using CA, polyethylene glycol (PEG), and silica. Thermal Induced Phase Separation (TIPS) was used to prepare membrane. The effect of addition of silica with varying amount of silica on properties membrane were investigated by examining hydrophilicity, permeation properties such as salt rejection, flux, and permeability.

MATERIAL AND METHOD

Cellulose acetate (CA, Mw 3000 Da, acetyl content 39%), polyethylene glycol-200 (PEG, Mw 200 Da) are purchased from Sigma Aldrich, fumed silica (SiO_2, particle size 0.2µm) were purchased from Sigma Aldrich. Aceton and sodium hydroxide used in this study are analytical grade.

A. Preparation of membrane CA/PEG

2 gram of CA and 0.5 gram of PEG was dissolved in 17 ml of acetone with constant stirring at 80ºC for 8 hours. Clear solution was obtained which was labeled as CP4. The solution was cooled in room temperature for 24 hours in sealed flask to make sure micro bubble disappear. The doped solution was casted on glass plate by maintaining the thickness. The temperature was lowered immediately to 5ºC for 15 minutes. Membrane was dried in oven at 60ºC for 24 hours. The clear and transparent membrane was carefully removed from glass plate.

B. Prepation of modified membrane

0.025 gram of silica 0.02 µm was dispersed in 2.5 ml of NaOH before adding to control solution with constant stirring at 80ºC for 10 hours. This modified solution was labeled as CPS2-1. The different amount of silica (0.05, 0.075, 0.1, 0.125 g) were used to prepared another modified solution, labeled as CPS2-2, CPS2-3, CPS2-4, CPS2-5. These solutions were casted and dried with same procedure as mention before.

RESULT AND DISCUSSION

Figure 1 shows that the hydrophilicity of modified membrane is higher than that of CA/PEG membrane. The increasing of silica increases the hydrophylicity of CA/PEG membrane.

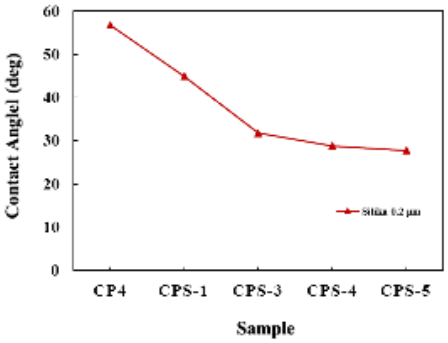

Figure 1. Contact angle of modified membrane

The increasing of CA/PEG membrane's hydrofilicity after the adition of silica is also shown in Fig. 2. The intensity of Si-OH bond at wavenumber 3400-3500

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cm $^{-1}$ increases by the increasing of silica content in membrane. This behaviour indicates the increasing of CA/PEG membrane's hydrofilicity due to the increasing of silica contents in CA/PEG membrane.

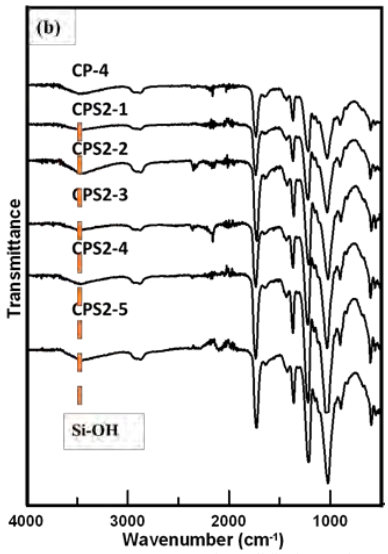

Figure 2. FTIR spectra of modified membrane

Permeate flux, salt rejection and permeability of CA/PEG membrane increases by the increasing of silica contents as shown in Table 1. This result is in agreement with the increasing of membrane's hydrofilicity.

Table 1. Permeation Properties

Variable	Permeate Flux ($L.m^{-2}.h^{-1}$)	Salt Rejection (%)	Permeability ($L.m^{-2}.h^{-1}.bar^{-1}$)
CP4	0.28	26.36	0.05
CPS2-1	0.15	29.87	0.02
CPS2-2	0.16	29.87	0.03
CPS2-3	0.22	34.25	0.04
CPS2-4	0.28	36.88	0.05
CPS2-5	0.56	36.88	0.11

CONCLUSION

In this study, hydrophilicity of CA/PEG membrane increases with the increasing of silica content as shown by the increasing of contact angle and Si-OH bond's intensity. Permeate flux, salt rejection, and permeability increase by the increasing amount of silica in membrane.

ACKNOWLEDGEMENTS

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REFERENCES

[1] Ahmad, S. Waheed, S. M. Khan, S. e-Gul, M. Shafiq, M. Farooq, K. Sanaullah "Effect of Silica on the properties of cellulose acetate/polyethylene glycol membranes for reverse osmosis", *Journal of Desalination*, vol. 355, pp.1–10, 2015.

[2] K. Lee, J. Kim "Effect of PEG additive on membrane formation by phase inversion", *Journal of Membrane Science,* vol. 138, pp. 153-163, 1997.

Synthesis Of Nickel (Ni) Doped HKUST-1 using Solvotermal Method With Addition of Acetic Acid as Modulator

Farhan Fikri Safii[1], Ratna Ediati[1]

Abstract – Hong Kong University of Science and Technology-1 (HKUST-1) is metal organic framework (MOF) that composed from ligand BTC (1,3,5-benzene tricarboxylic) and copper ions. The method used in this study is solvotermal with variations nickel ion doping and additions acetic acid as modulator. The purpose of this study is to increase the hydrogen storage capacity. The results obtained were characterized by XRD showed that the HKUST-1 and Ni-HKUST-1 has formed, showed by peaks at 2 theta = 6.7, 9.5, 11.6, 13.4, and 19.0.

Index Terms – Doping nickel, HKUST-1, MOF.

INTRODUCTION

Metal Organic Framework (MOF) is porous crystalline material composed by coordination bonds between metal ion and multi dentate organic ligand forming a three-dimensional extended network with cavities [1]. MOF have large surface area (500-6500 m^2/ g), low density (0.17 to 1.7 g/cm^3) and controllable pores, and have been applied as gas storage, in particular hydrogen gas [2]. Hydrogen storage in MOF is performed by physisorption which influenced by the interaction of molecular hydrogen with MOF surface, surface area and pore volume [3].

Among other MOFs, HKUST-1 is capable of storage H_2 effectively. HKUST-1 (Hong Kong University of Science and Technology-1) is composed of a ligand BTC (1, 3, 5-benzene tricarboxylic) and copper ions in the lattice cube (Fm-3m). Cu^{2+} ions form a dimer in which each copper atom coordinated with four oxygen sources from the linker 1, 3, 5-benzene tricarboxylic and water molecules. The existence of water molecules in the first coordination copper ions directs the possibility of the presence of a coordinative vacancy on the species Cu^{2+}, so HKUST-1 has the potential for interaction with hydrogen and can be applied as a hydrogen storage material [4].

HKUST-1 has been reported [4-5] as a hydrogen storage material and has a hydrogen storage capacity 0.47 and 0.02% at temperature of 30 °C. Hydrogen storage capacity in the HKUST-1 has been reported to be lower than that of MIL-101 which has hydrogen storage capacity 1.14 wt.% [6], therefore it is necessary to increase the hydrogen storage capacity in the HKUST-1. Increasing the surface area and pore volume with doping metal ions and the addition of a modulator during the synthesis is one of method to increase the hydrogen storage capacity as reported [7-8]. This study reports the synthesis of nickel doping in HKUST-1 ($Cu_3(BTC)_2$) with solvotermal method and the addition of acetic acid as a modulator.

MATERIAL AND METHOD

A. Material

Cupric nitrate trihydrate ($Cu(NO_3)_2.3H_2O$) (Merck 99,0%), nickel nitrate hexahydrate ($Ni(NO_3)_2.6H_2O$) (Merck 99,0%), acetic acid (Merck 99,0%), Benzene-1,3,5-tricarboxylic acid (H_3BTC) (Sigma-Aldrich, 99,0%), N'N-dimethylformamide (DMF) (Merck, 99.8%), ethanol, methanol and aquades.

B. Procedure

Synthesis of HKUST-1. Cupric nitrate trihydrate (4,19 g) was dissolved in 33 mL of aquades. Benzene-1,3,5-tricarboxylic acid (2,10 g) was dissolved in 67 mL of solvent consisted by DMF : etanol (1:1 v/v). Cupric nitrat and benzene-1, 3, 5-tricarboxylic acid solutions are mixed and stirred. The mixture was transferred into teflon-lined stainless steel autoclave. It was kept in oven at temperature of 120 ℃ for 12 hours. After 12 hours, the autoclave was cooled down naturally into room temperature. Products were separated by filtration and washed by DMF and methanol. Then it was dried at room temperature. The procedure above was repeated with the addition of acetic acid as a modulator.

Synthesis of Ni-HKUST-1. synthesis of Ni-HKUST-1 was performed by similar procedure of HKUST-1 as described above with some modification of nickel nitrate hexahydrate ($Ni(NO_3)_2 \cdot 6H_2O$) addition. The weight ratio of ($Cu(NO_3)_2 \cdot 2.5H_2O$) and $Ni(NO_3)_2 \cdot 6H_2O$) are 95:5; 90:10; 80:20 and 70:30%. The result will be characterized by XRD, FTIR, SEM, Nitrogen Adsorption-Desorption, TGA.

RESULT AND DISCUSSION

Blue colored was obtained from the synthesis. Solids synthetic results adding with acetic acid as the modulator has a smaller mass than the solids synthesized without added acetic acid. XRD characterization of all samples show in Figure 1.

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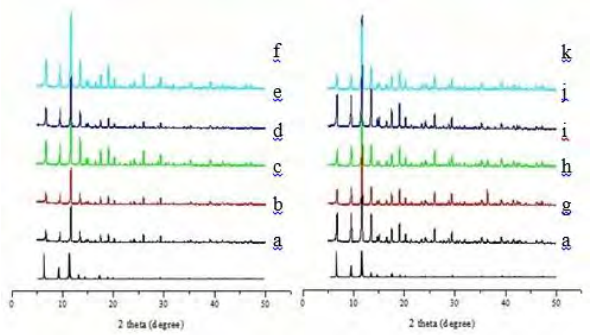

Figure 1. XRD pattern of HKUST-1 and Ni-HKUST-1 a) simulated, b)100% Cu, c)5% Ni, d) 10% Ni, e) 20% Ni, f)30% Ni, g)100% Cu + Mod, h)5% Ni + Mod, i)10% Ni + Mod, j)20% Ni + Mod, k)30% Ni + Mod

According to Figure 1, synthesized materials show peaks at 2 theta = 6.7, 9.5, 11.6, 13.4, and 19.0. Those characteristic peaks correspond to peaks of simulation and material HKUST-1, which has been reported [9]. This indicates that HKUST-1 has been formed. Ni ion doping in HKUST-1 does not change the pattern of diffractogram of Ni-HKUST-1 for all concentration studied. This shows that the doping metal ions Ni does not affect the structure of HKUST-1. To observe the morphology of the HKUST-1 and Ni-HKUST-1 materials the SEM analysis was performed and shown in Figure 2.

As seen in Figure 2, that the HKUST-1 and Ni-HKUST-1 have the shape of octahedral morphology. The doped HKUST-1 looks octahedral more regular than that of without doping, which is not doped and added with a modulator.

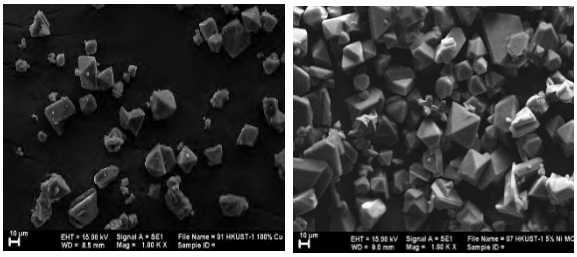

Figure 2. Photo sem of HKUST-1 and Ni-HKUST-1

CONCLUSION

In this study HKUST-1 and Ni-HKUST-1 has been successfully synthesized. Ni doping does not affect to the morphology of HKUST-1.

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REFERENCES

[1] Wee, Lik H, et al., "Heteropolyacid encapsulated in $Cu_3(BTC)_2$ nanocrystals: An effective esterification catalyst" Catalysis Today, Vol. 171, hal. 275– 280, 2011.

[2] Xiang, Zhonghua, et al., "Lithium Doping On Metal-Organik Framework for Enhancing H_2 Storage" International Journal of Hydrogen Energy, Vol. 30, hal. 1-5, 2011.

[3] Sculley, Julian, et al., "The current status of hydrogen storage in metal–organic frameworks—updated" Energy Environ. Sci., Vol. 4, hal. 2721-2735, 2011.

[4] Lin, Kuen Song, et al.,"Synthesis and characterization of porous HKUST-1 metal organic frameworks for hydrogen storage", International Journal of Hydrogen Energy, Vol. 37, hal. 13865-13871, 2012.

[5] Ya Liu, Ying, et al., "Improved hydrogen storage in the modified metal-organic frameworks by hydrogen spillover effect", International Journal of Hydrogen Energy, Vol. 32, hal. 4005 – 4010, 2007.

[6] Li, Yingwei and Ralph T. Yang "Hydrogen Storage in Metal-Organic and Covalent-Organic Frameworks by Spillover", AIChE Journal, Vol. 54, hal. 269-279, 2007.

[7] Na Li-yan, et al., "Nano/Micro HKUST-1 Fabricated by coordination Modulation Method at Room Temperatur", Chem. Res.Chinese Universities. Vol 24, hal. 555-558, 2012.

[8] Wang, Fangli, et al., "The controlled regulation of morphology and size of HKUST-1 by "coordination modulation method"", Microporous and Mesoporous Materials, Vol. 173, hal. 181–188, 2013.

Silica-Coated Mesoporous Carbon as Solid Dessicant in Gas Dehydration Process

Fadlilatul Taufany[1], Fahmi[1], Nurhamidah[1]

Abstract – Dehydration process using solid desiccant is required to reduce water content to meet pipeline gas GPSA specification (4-7 lb/MMscf). Porous silica gel has a high specific surface area (Grade 12 brand Davisil 800 m^2/g), which is generally obtained via a high-cost supercritical technology. This research aims to substitute that of high-cost super critical technology by developing silica-coated mesoporous carbon. This research uses an impregnating-silica method consisting of pretreatment and hydrophilication processes. Here we found that the pretreatment process can increase the surface area of mesoporous carbon from 504.122 m^2/g to 823.5 m^2/g. While for the hydrophylication process, silica-coated mesoporous carbon was obtained via mechanical and chemical force. Silica-coated mesoporous carbon has adsorption capacity 70.59% of commercial silica gel.

Index Terms – Gas dehydration, Hydrophilication, Mesoporous carbon, Silica-coated mesoporous carbon.

INTRODUCTION

The diminished source of world natural gas encourage the application of modern and sophisticated technology in natural gas exploration, such as the use of water injection technology [1], which is designated to trigger the gas out of its well. The use of such technology results more water carried away in the gas from the well, consequently, the moisture content in natural gas is predicted to continue increasing in the future. Significant quantities of water vapor consisted in natural gas can caused many pipeline problems. Dehydration process using solid desiccant (silica gel is the most commonly used) is obviously required to reduce water content to meet pipeline gas specification GPSA, *i.e*.4-7 lb/MMscf [1].

Porous silica gel has a high specific surface area, *i.e*. Grade 12 brand Davisil 800 m^2/g [2]. To form the high specific surface area, a high-cost supercritical technology should be used in the drying process of silica gel manufacture. In other hand, activated mesoporous carbon has high surface area to 1050 m^2/g for Aquasorb 2000 brand [3]. Activated carbon mesoporous has hydrophobic surface so that can't be used for dehydration process efectively. To form hydrophilic mesoporous carbon with high surface area, carbon need to be coated by silica.

In this paper, a detailed study of carbon hydrophilication is reported. These hybrid materials were prepared with activated mesoporous carbon by using sodium silicate solution as precursors. The impact of mechanical and chemical force were investigated by FTIR analisys and dehydration test.

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MATERIAL AND METHOD

Mesoporous carbon (surface area 504.122 m^2/g), Sodium Silicat solution (0.1 %.wt), sodium lignosulfonate (SLS) solution as water-based surfactant (0.1% wt.), H_2SO_4 solution (4 N), biogas, and comercial silica gel.

A. Pretreatment

20 gram of mesoporous carbon put in the pretreatment reactor. Using kinetically control method, compressed air (oxidant) was flowed to the reactor 2 Lpm and heated to 300^{o}C for 60 minutes. Activated carbon was stored in oven with 110^{o}C for 24 hours.

B. Hydrophilication

20 gram activated carbon from pretreatment was immersed in sodium silicate solution (0.1%.wt) for 19 hours. Then, stirred using magnetic stirrer for mechanical variable (0, 500, and 1000 rpm). The carbon was filtered using filter paper before it stored in oven with 110^{o}C for 24 hours. Carbon immersed in H_2SO_4 solution (4 N) for 24 hours, and then was filtered using filter paper before it stored in oven with 110^{o}C for 24 hours. Carbon was washed with aquadest and stored in oven with 110^{o}C for 24 hours [3]. The methode was repeated for chemical force variabel, carbon immersed in mixed sodium silicate solution (0.1%.wt) and (SLS) solution (0.1%.wt).

C. Gas Dehydration

17 gram of silica gel was put inside the reactor, and 150 L of biogas was flowed into reactor with rate of 7-8 lpm. Mass of silica gel was weighted before and after dehydration process. These steps were repeated for mesoporous carbon and silica-coated mesoporous carbon.

RESULT AND DISCUSSION

A. Impact of Pretreatment

Pretreatment process can increase the surface area of mesoporous carbon from 504,122 m^2/g to 823,5 m^2/g, make it as a fibrous structure.

B. Impact of Physical Force

The FTIR analisys result showed that the most increasing of silica content is at the rotation speed of 500 rpm. The introduction of mechanical force by means of stirring significantly helps the deposition of silica on mesoporous carbon surface. However when the rotation speed of stirring process is too high, i.e. 1000 rpm, probably will create a thermodynamic controlled condition, where the silica is not deposited as bulk structure instead of one layer.

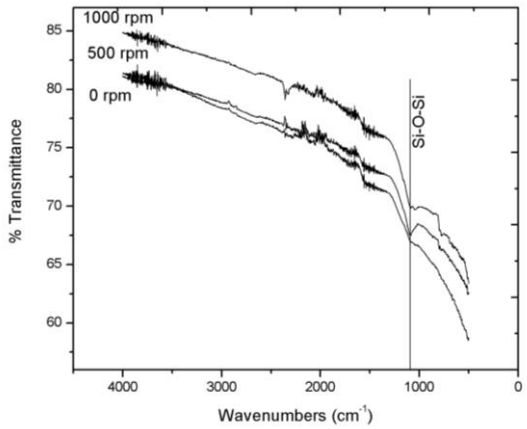


Figure 1. FTIR analisys of the silica-coated mesoporous carbon after different applied rotation speed of hydrophilication process.

C. Impact of Chemical Force

The FTIR analisys results showed that SLS surfactant can increase the quantity of silica. This can be explained by the fact that the role of surfactant is to reduce the surface tension of mesoporous carbon surface with its solution environment, thus the silica can be easily deposited onto a mesoporous carbon surface.

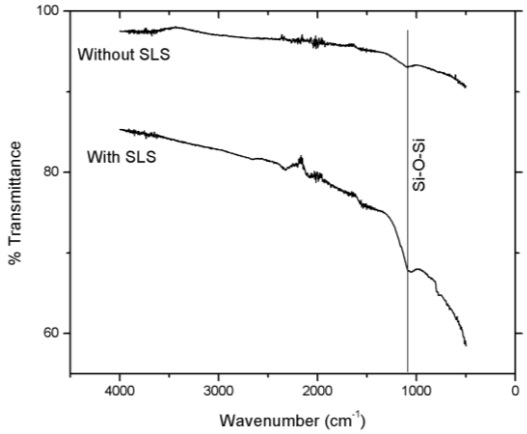


Figure 2. FTIR analisys of the silica-coated mesoporous carbon after different concentracion of SLS surfactant.

D. Gas Dehydration Test

Water adsorption capacity of mesoporous carbon was found to be 1.2 %, while for that of silica-coated mesoporous carbon and respective comercial silica gel was found to be 5.6% and 8%, respectively. This indicate that our proposed silica-coated mesoporous carbon has 70% water adsorption capacity compared with its respective commercial sample, *i.e*. silica gel

CONCLUSION

Here we found that the most increasing of silica content on the resulted silica-coated mesoporous carbon at a rotation speed of 500 rpm. Additionally, sodium lignosulfonate as surfactant can increase quantity of deposited silica. Finally, when this silica-coated mesoporous carbon is subjected into a gas dehydration process using a biogas, we found that its adsorption capacity was 70,59 % of that commercial silica gel.

REFERENCES

[1] Arthur J. Kidney, Parrish, R. William, 2006. *Fundamentals of Natural Gas Processing*. New York: Taylor & Francis

[2] Carbon, Jacobi. 2005. *AquaSorb Technical Data Sheet*. United States.

[3] Yamamoto, Eri., Kobayashi, Jun., Kanamaru, Keiko., Miura, Toshinaki., Watanabe, Fujio., Kobayasi, Noriyuki., Hasatani, Masanobu. 2003. *Hydrophilication of Activated Carbon by Impregnating Silica into Pores*. Department of Energy Engineering and Science Nagoya University, Nagoya 464-8603. Japan

Work Function Modulation with Self-assembled Monolayers: Effect of Dipole Moment on Packing Density

Nia Nurfitria[1], Yu-Tai Tao[2], Ding-Chi Huang[3]

Abstract – A series of benzylmercaptans carrying different para-substituents were used to form self-assembled monolayers on gold in order to modulate the work funtion of the metal electrode. Ellipsometry, Reflection Absorption Infrared Spectroscopy (RAIRS), and cyclic voltametry were used to chracterized the structure of the monolayer. The results show that as the dipole moment increases in the molecule, the surface coverage decreases. This can be the reason that a more polar molecule does not necessarily generate work function change proportionally.

Index Terms – Work function, Self-assembled monolayer, Dipole moment.

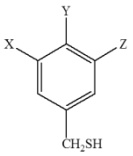
INTRODUCTION

Organic electronics are attracting much attention in recent years. For example, flat panel displays based on Organic Light-Emitting Diodes (OLEDs) have a tremendous market, almost $50 billion in value in portable electronic devices based on OLEDs, like mobile phone, camera, laptop, etc [1]. So, improving the efficiency and performance of the OLEDs become a continued research effort and focus. In an OLED device, charge injection that occurs at the interface between the electrode and the organic layer is the first factor that needs to be addressed while study efficiency and performance of the device. Charge injection will influence the driving voltage and also the luminesence from the device [2]. A Schottky barrier present at the metal/organic interface has a big effect on the charge injection process. This barrier results from the different alignment of the electrode work function and the Highest Occupied Molecular Orbital (HOMO) for hole injection, or the Lowest Unoccupied Molecular Orbital (LUMO) for electron injection into the organic semiconductor [3]. To reduce the barrier, one can use molecule with different HOMO (LUMO) levels or metals with different work function.

Surface modification of the metal electrode with Self-Assembled Monolayer (SAM) of organic molecule has been a popular way to modulate the work function and thus change the energy barrier. The extent of work function change ($\Delta\Phi$) depends on the size and direction of dipole moment the molecule carries, as well as the number of the molecules adsorbed on the surface, as shown in equation 1.

$$\Delta\Phi = \frac{e\mu_{\perp}}{\varepsilon_0 A} \quad (1)$$

With ε_0 is the vacuum permitivity, $\mu_{\perp}$ is molecular dipole along surface normal and A for surface area per absorbed molecule [4]. To effect a large change of work function, molecule with larger dipole moment is favored. Nevertheless, the molecular dipole moment may also affect the assembling of the monolayer because of electrostatic repulsion between dipoles oriented in the same direction in a monolayer on substrate.



Molecule	X	Y	Z
1	H	H	H
2	F	F	F
3	H	CF_3	H
4	H	SCF_3	H
5	H	SO_2CF_3	H

Figure 1. Structure of benzyl mercaptan series

In this work, benzylmercaptans carrying different para-substituents (Figure 1) were used to form self-assembled monolayers on gold. Ellipsometry, Reflection Absorption Infrared Spectroscopy (RAIRS), and cyclic voltammetry were used to characterized the structure of the monolayer. The results show that as the dipole moment increases in the molecule, the surface coverage decreases. This can be the reason that a more polar molecule does not generate work function proportionally.

MATERIAL AND METHOD

The thiol compounds were synthesized and fully characterized in the laboratory. Reflection-absorption IR spectra were taken with a Bio-Rad FTS-60 infrared spectrometer equipped with a MCT detector. The 86° incidence angle and p-polarized were used for the measurement. Work function of the self-assembled monolayer modified gold was measured with a photoelectron spectrometer (AC-2, Riken Keiki, Japan) with an UV source.

The gold substrates were prepared by a vapour deposition of 100 nm gold (99.99%) onto freshly cleaned 1-in silicon wafer. A 10 nm chromium (99.99%) were deposited as adhesion layer before gold deposition. The thiolate monolayer was prepared by immersing the gold substrates in the ethanolic solution for 24h and then rinsing with pure ethanol before characterization.

RESULT AND DISCUSSION

RAIRS spectra (Figure 2) and the experimental thickness (Table 1) from ellipsometry measurements proved that self-assembled monolayer succesfully adsorbed on gold surface. According to equation 1, the

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work function change should be proportional to the fraction of dipole along the surface normal. The calculation from Spartan program shows that the dipole moment for all molecules (except benzyl mercaptan) are pointing away from the anchoring sulfur group due to the electron-withdrawing nature of the substituents. The dipole moment increases in going from **2** to **5**. But, the measured work function for the monolayer-covered surface does not increase in the same order. This may have to do with number of molecules adsorbed on each sample or the size of the dipole along the surface normal.

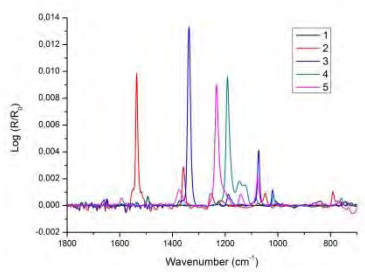

Figure 2. Reflection Absorption IR spectra of SAM-modified gold surfaces.

The cyclic voltammetry was used to estimate the surface coverage by integration of the areas under the reductive desorption wave in each sample (Figure 3). As can be seen from Table 2 that molecule **5** , which has highest dipole moment, has the lowest surface coverage, nearly 60% of that of the nonpolar compound **1**. Compound **3** also has low coverage. The loose coverage, presumably due to the repulsion between the neighboring dipoles, also make the adsorbed molecule more tilted away from the surface normal, making the component along the surface normal small.

Table 1. Thickness of various monolayers by ellipsometry.

Molecule	Thickness Å (theoretical)	Thickness Å (experimental)
1	8.399	9.17
2	8.651	9.48
3	9.288	10.73
4	11.132	11.6
5	11.219	9.82

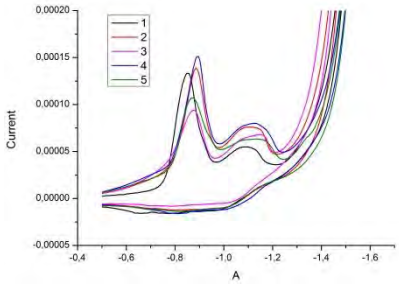

Figure 3. Cyclic voltammogram of SAM-modified gold samples.

Table 2. Dipole moment, work function and surface coverage of SAM-covered Au substrates.

Molecule	Dipole (D)	Work Function (eV)	Surface Coverage ($mol.cm^{-2}$)
1	1.705	4.48	7.80×10^{-10}
2	3.985	5.46	6.13×10^{-10}
3	4.162	5.44	5.04×10^{-10}
4	4.246	5.51	6.66×10^{-10}
5	8.129	5.28	5.07×10^{-10}

CONCLUSION

In this study, hydrophilicity of CA/PEG membrane increases with the increasing of silica content as shown by the increasing of contact angle and Si-OH bond's intensity. Permeate flux, salt rejection, and permeability increase by the increasing amount of silica in membrane.

ACKNOWLEDGEMENTS

This work has been financially supported by BOPTN funding for 2015 in the scheme of Decantralization, to which the authors express their sincerest gratitute.

REFERENCES

[1] H. Klauk, *Organic Electronics: Material, Manufacturing and Applications*. Weinheim, Jhon Wiley & Sons, Technologycal and Engineering, 2006.

[2] Y. Tokudome, et al., "Enhanced Hole Injection in Organic Light-Emitting Diode by Optimized Synthesis of Self Assembled Monolayer". *Organic Electronics*, vol. 12, pp. 1600-1605, 2011.

[3] N. Koch, "Organic Electronic Device and Their Functional Material". *ChemPhysChem*, vol. 8, pp. 1438-1455, 2007.

[4] S. Osella, et al., "Work Function Modification of the (111) Gold Surface Covered by Long Alkanethiol-Based Self-Assembled Monolayer". *Physical Chemistry Chemical Physics*, vol. 16, pp. 2866-2873, 2014.

Conceptual Model Cognitive, Affective, Physical, and External Factor for Individual Information Technology Acceptance

Anfazul F. Azizah[1], Tony Dwi Susanto[1]

Abstract – Information technology growth provides a lot of opportunity for business and industries. Information technology provide chances to business and industries to improve their ability effectiveness and efficiency. Information technology provide more effective data which can be use to analyze the business process. But many business and industry specially home industry which cannot take the advantage of information technology growth and effect to loss opportunity to built time to market correctly and can predicted market behaviors. There are several factors that affected in decisions making related to the use of information technology are factor cognitive, affective factors, physical factors and external factors that can be analyzed to determine the effect the relationship between the four factors in decision making.

Index Terms – Acceptance, technology.

INTRODUCTION

In line of information technology growth directly proportional to the increase of the technological needs of the individual. Information technology provide many advantage for individuals or industries in resolving problems or create the business processes more effective and efficient.

The formulation of the problems can be concluded are factors influence the approach among cognitive, affective, physical and external factors in the acceptance of a technology, probably it will take several approaches in this research are: 1. Make construction conceptual model that can describe the approach among the factors (cognitive factor, affective factor, physical factor and external factor) that affect the individual in acceptance of information technology, 2. Designing a survey based research models, pre-survey, 3. Examine the approach among the factors (cognitive factor, affective factor, physical factor and external factor) that affect an individual in receipt of a technology, 4. The conceptual model to make decision according approach through certain indicators.

MATERIAL AND METHOD

The methodology is divided into several stage list, they are: 1. Study literature, 2. Identification of problems, 3. Determination of objectives, constraints and contributions, 4. Design, 5. Implementation, 6. Testing and analysis results, 7. Reporting. The research will be done by conducting a survey to get sampling of the respondents to the application of hypothesis testing. Data collection techniques is used in this research by distributing questionnaires to the respondents who have been determined empirically in order to obtain data relating to the hypotheses that have been proposed and used like scale to assess the research instrument. The analysis technique is used in this research analysis of descriptive analysis and inferential analysis. Descriptive analysis is describing the data based on the tendency of respondents to the question items related to indicators of research variables.

RESULT AND DISCUSSION

A. Designing emotionally evocative homepages: an empirical study of The quantitative relations between design factors and emotional dimensions

The emotional aspects of the homepage is becoming important due to people spend their time in cyberspace. In this study aims to identify the quantitative approach among the factors of design and dimensions of the secondary emotions that done by targeting the development homepage emotions more effectively.

B. The impact of colour on Website appeal and users cognitive processes

In this study conducted 2 pilots of study that focused on one specific feature, namely the color of the website. The first study investigated the preferences of colors chosen by designers and users are 23 sites homepage with different color variations. While the second study analyzed the impact measurement of 3 different colors (chosen based on the results of the first study) both subjectively and objectively. Whereas in designing various color versions homepage, we need a calculation so that the color can be defined into three dimensions: hue, value and chroma

C. Effects of four workplace lighting technologies on perception, cognition and affective state

In this research, testing of visual perception, affective and cognitive used LED lighting system with a color temperature and illumination are varied. Four lighting technologies include fluorescent (3345 K) and three LED technologies that are labeled with a color temperature as follows: LED 1 (4175 K), the LED 2 (5448 K) and LED 3 (6029 K). For the environment (a) experiments were performed at the tent / indoor spaces controlled by Tent Expandable Modular Personnel (TEMPER) 320L x 20 '6' W military shelter (640 sq ft)

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D. Human factors in computer simulations of urban environment. Differences between architects and non-architects' assessments

In this research, the identification of affective responses that may affect the evaluation of the urban environment and analyze the preference model of architects and non-architects. Here is an example of urban design model of the preferences of architects and non-architects:

E. The effects of light blue and white backgrounds on the brain activity of Web-based English tests' takers

In this study, the authors conducted an experiment to see how the background color of a web-based tests (WBTs) can affect the brain activity of web-based test takers in relation to performance. A total of 30 subjects (20s) were included to test web-based English grammar tests and also test the counting circle on a computer screen with a blue background and white. For the second background color, text and symbols are presented in black.

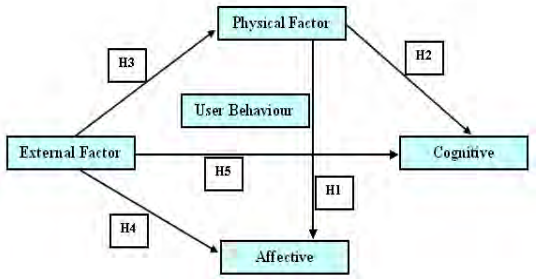

Figure 1. Modeling Design

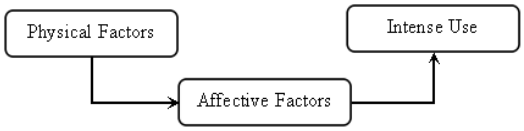

Figure 2. Modelling Physical → Affective

CONCLUSION

Based on the analysis of the study concluded that:
Physical factors can influence the user affective factor

- Establishment of a specific design of the homepage can affect the feelings of the user.
- Use of certain colors on the homepage but can evoke certain emotions, can also affect behavior intention (intention to buy / shopping).

Physical factors can affect user cognitive factor

- This study shows that color - a particular color can affect the quality of the performance of the brain.
- This study shows that areas in the brain associated with linguistic task tend to have higher concentrations of Hb with light blue background than on a white background.

External factors can affect the user's physical factors.

- In this study comparing the effects of repeated measurements of four lighting technology (a neon, three LED) to the basic visual acuity.
- External factors can affect the user affective factors. This study shows that the effect of the lighting can affect the level of individual feelings
- This study shows that the advanced picture successfully evokes the feelings and emotions that can be stimulated with the room.

The external factors may influence user cognitive factor.

- The study also showed that the effect of the lighting can affect the workings of the brain.

REFERENCES

[1] Tony Dwi Susanto, Ph.D, Individual Acceptance of e-Government: A Literature Review. *SDIWC.978-0-9891305-2-3 ©SDIWC., 2013.*

[2] Jinwoo Kim, Jooeun Lee, Dongseong Choi, *D*esigning emotionally evocative homepages: an empirical study of the quantitative relations between design factors and emotional dimensions. *Elsevier*, *2003*.

[3] Chih-Chieh Yang, Hua-Cheng Chang, *Selecting representative affective dimensions using Procrustes analysis: An application to mobile phone design. Elsevier, 2012.*

[4] Atsuko K. Yamazaki, Shinji Koizumi, Hitomi Shimada, Kaoru Eto. *The effects of light blue and white backgrounds on the brain activity of Web-based English tests' takers*. Elsevier. 2014

[5] Ngo, D., Byrne, J., A*pplication of an aesthetic evaluation model to data entry screen.* Computers in Human Behavior 17, 149–185, 2001

Simulation of Generalized Space-Time Autoregressive with Exogenous Variables Model with X Variable of Type Metric

Reza Mubarak[1], Suhartono[1]

***Abstract* – One of the models time series which also involves spatial aspects (spatio-temporal) is Generalized Space Time Autoregressive (GSTAR). Until now, GSTAR modelling don't involve metric-type, which is called GSTARX. Parameter estimation for spatio temporal modeling is still limited by using Ordinary Least Square (OLS) which is less efficient because the residuals are correlated. Generalized Least Square (GLS) is one of the alternative methods for parameter estimation residuals are correlated. In this study would like to looking at the efficiency of GLS estimation method is compared with OLS to correlated data in GSTARX model. Simulation results show that the estimation GLS method is more efficient than using OLS if residual correlated.**

***Index Terms* – GSTRAX, OLS, GLS, Simulation.**

INTRODUCTION

Forecasting has become an important part of human life in various aspects. One of the models time series which also involves spatial aspects (spatio-temporal) is Generalized Space Time Autoregressive (GSTAR). However, in its application to the development GSTAR involving an exogenous variable is still much to do, especially with the exogenous variables of type metrics.

Spatio temporal modeling parameter estimation is still limited by using Ordinary Least Square or OLS [1] and Maximum Likelihood [2]. Terzi argues parameter estimation by OLS on GSTAR less efficient due to residual correlated. Generalized Least Square (GLS) is one of the alternative methods for parameter estimation of residual cross-correlated.

The purpose of this research is looking at the efficiency of GLS estimation method is compared with OLS to correlated data in GSTARX model.

LITERATURE REVIEW

A. GSTAR

STAR model assumes autoregressive parameter is the same for each location, so that the STAR model can only be used on the same location or homogeneous. Whereas, on the assumption that there is GSTAR states allowed different parameters for each location, so GSTAR used at research sites that are heterogeneous [3].

GSTAR model of order autoregressive (time) and spatial order $\lambda_1, \lambda_2, \dots, \lambda_p$, GSTAR $(p; \lambda_1, \lambda_2, \dots, \lambda_p)$ in matrix notation can be written as follows :

$$\boldsymbol{Y}(t) = \sum_{k=1}^{p}\left[\boldsymbol{\Phi}_{k0}\boldsymbol{Y}(t-k) + \sum_{l=1}^{\lambda_p}\boldsymbol{\Phi}_{k1}\boldsymbol{W}^{(l)}\boldsymbol{Y}(t-k)\right] + \boldsymbol{\varepsilon} + \boldsymbol{\varepsilon}(t) \quad (2)$$

Where,

$\boldsymbol{\Phi}_{k0}$ = $diag\left(\phi_{k0}^{(1)}, \dots, \phi_{k0}^{(N)}\right)$ is time parameter matrix

$\boldsymbol{\Phi}_{kl}$ = $diag\left(\phi_{kl}^{(1)}, \dots, \phi_{kl}^{(N)}\right)$ is spatial parameter matrix

$\varepsilon(t)$ = noise vector size (N x 1) is an independent, identical, multivariate normal distribution with mean zero and variance-covariance matrix $\sigma^2\boldsymbol{I}_N$.

Weighting values are chosen so that, to qualify $w_{ii}^{(k)} = 0$ and $\sum_{i\neq j} w_{ij}^{(k)} = 1$.

MATERIAL AND METHOD

Steps in the modeling GSTARX-OLS and GSTARX-GLS on this simulation data is as follows:

1) Generating residual data multivariate normal distribution with mean zero and variance-covariance matrix $E(\varepsilon\varepsilon')$ for the three locations and n = 300.
2) Coefficient parameters used in the model GSTARX ($[1]_1$) in accordance with the terms of stationary parameters GSTAR, namely eigenvalues parameter is less than one, then be written $|\lambda\boldsymbol{I} - \Phi|$, $|\Phi| = |\lambda\boldsymbol{I}|$, with $\lambda_i < 1$. The parameters used can be seen in the following matrix equation:
$$\Phi_1 = \begin{bmatrix} 0{,}35 & 0{,}30 & 0{,}30 \\ 0{,}25 & 0{,}45 & 0{,}25 \\ 0{,}20 & 0{,}20 & 0{,}40 \end{bmatrix}$$
3) Data generated residual formed into a VAR(1) model which these data will be exogenous variables Xt.
4) Perform again step 1) and forms into VAR(1) model and coefficient parameter is :
$$\Phi_1^* = \begin{bmatrix} 0{,}15 & 0{,}22 & 0{,}22 \\ 0{,}12 & 0{,}20 & 0{,}12 \\ 0{,}18 & 0{,}18 & 0{,}10 \end{bmatrix}$$
and variance covariance matrix as follows :
   a. Residual not correlated between all location, same variance (Simulation 1)
   b. Residual not correlated between all location, different variance (Simulation 2)
   c. All residual correlated between all locations with the same variance (Simulation 3)
   d. All residual correlated between all locations with the different variance (Simulation 4)
   e. Residual correlated between some locations with the same variance (Simulation 5)

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f. Residual correlated between some locations with the different variance (Simulation 6)

This step of formed the variable y_t.

5) Getting the data series $Y_{i,t}$ three locations with the effects of calendar variations as well as a predictor of type metric with two scenarios. Effect all the same locations on the predictors of type metrics in the following scenarios:
   a. Order is b = 1, r = 0, s = 1
   b. Order is b = 1, r = 0, s = 2
6) GSTARX estimating model parameters with OLS and GLS method.

Comparing the results of model estimation GSTARX-OLS and GSTARX-GLS and calculate the efficiency of the method GLS.

RESULT

Table 1. Provides the results of the sixth simulation.

Simulation	Φ^*_{ij}	Efficiency 1st	Efficiency 2nd	Simulation	Φ^*_{ij}	Efficiency 1st	Efficiency 2nd
1	Φ^*_{10}	0.04	0.12	4	Φ^*_{10}	31.99	31.96
	Φ^*_{20}	0.04	0.33		Φ^*_{20}	20.72	21.18
	Φ^*_{30}	0.05	0.42		Φ^*_{30}	21.35	17.92
	Φ^*_{11}	0.02	0.07		Φ^*_{11}	28.02	28.16
	Φ^*_{21}	0.02	0.16		Φ^*_{21}	13.99	14.29
	Φ^*_{31}	0.03	0.21		Φ^*_{31}	17.60	13.90
2	Φ^*_{10}	0.37	0.50	5	Φ^*_{10}	4.09	1.08
	Φ^*_{20}	0.10	0.72		Φ^*_{20}	3.74	8.37
	Φ^*_{30}	0.45	0.27		Φ^*_{30}	8.63	9.86
	Φ^*_{11}	0.22	0.29		Φ^*_{11}	2.59	0.62
	Φ^*_{21}	0.05	0.40		Φ^*_{21}	2.07	5.38
	Φ^*_{31}	0.31	0.18		Φ^*_{31}	6.41	7.10
3	Φ^*_{10}	9.66	14.52	6	Φ^*_{10}	10.22	12.41
	Φ^*_{20}	4.45	8.50		Φ^*_{20}	23.28	37.63
	Φ^*_{30}	9.09	9.08		Φ^*_{30}	70.28	73.51
	Φ^*_{11}	7.33	11.80		Φ^*_{11}	4.70	6.62
	Φ^*_{21}	2.93	5.62		Φ^*_{21}	6.12	26.89
	Φ^*_{31}	6.19	6.36		Φ^*_{31}	67.01	70.81

Table 1 that the value of efficiency has to be all positive, which means that estimates using GLS better than the OLS.

CONCLUSION

The results of simulation 1 and 2 show that if the locations is correlated so parameter estimation GLS is not more efficient than OLS. However, the different results obtained in simulation 3 to 6 provide GLS more efficient if between locations correlated.

REFERENCES

[1] N. Ruchjana, "Pemodelan Kurva Produksi Minyak Bumi Menggunakan Model Generalisasi STAR". Forum Statistika dan Komputasi IPB. Bogor, 2002.

[2] S. Terzi, "Maximum Likelihood Estimation A Generalized STAR (p; 1_p) Model," pp.154–178. Roma: Universitas La Sapienza. 1995.

[3] S. A. Borovkova, H. P. Lopuhaä, and Ruchjana, B.N, "Least Square Estimation of Generalized Space Time Autoregressive (GSTAR) Model and Its Properties," The 5th International Conference on Research and Education in Mathematics, 2008.

Interfacial Properties and Foamability of Amphiphilic Molecules

Stella Widyaningtyas[1], Audrey Drelich[2], Isabelle Pezron[2]

Abstract – Surface-active molecules are widely used in industry. Triton X-100, sodium lauryl ether sulfate, sodium dodecyl sulfate and bovine serum albumin are commonly used in daily products. They can form foams because of adsorption phenomena at the surface. Each molecule has its own characteristic and foaming ability. This research deals with relation between interfacial properties and foamability by using three different methods: the Wilhelmy plate method to verify the CMC value, the maximum bubble pressure to determine dynamic surface tension, and the Bikerman method to assess the foamability. Interfacial properties and foamability will be studied and the difference observed between surfactant and protein will be discussed.

Index Terms – Foamability, Interfacial Properties, Protein, and Surfactant.

INTRODUCTION

Surfactant is an amphiphilic molecule which has hydrophobic and hydrophilic parts. These different structures make surfactants as emulsifier, foaming, and wetting agent. When it is used in dispersed solution, it will minimize contact between the hydrophobic part and water which leads to adsorption at interfaces and causes a decrease in interfacial tension between air/water. At one point, the system interface is saturated with surfactants; the molecules have ability to auto-associate in aggregate called "micelles". The concentration at which the monomers begin to form micelles is defined as the Critical Micelle Concentration (CMC) [1].

The main phenomenon in surfactant solution foaming properties originates from adsorption of the surfactant at air/liquid interface [2]. First of all, the decrease in surface tension allows the fragmentation of gas as small bubbles. Foam can be defined as dispersion of a gas in a liquid. It is thermodynamically unstable. Different types of surfactant can be used to control the foamability and foam stability. The amount of foam produced depends on the surfactant concentration, and it is preferred to operate at a value near or slightly superior than the CMC [3].

Proteins have complex structure and high molecular mass. Otherwise, their easy biodegradation makes their use in various industrial applications. Bovine Serum Albumin is a water-soluble protein and has ability to form hydrogen bonds both within its own structure and with polar solvents [4]. They are characterized by their Critical Aggregation Concentration (CAC).

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In industry, surfactants are used based on their function, properties, and foaming ability. In this study, we compare the behavior of surfactants and protein that are used in our daily products.

MATERIAL AND METHOD

A. Materials

Pure components samples of Triton X100, Sodium Lauryl Ether Sulfate (SLES), Sodium Dodecyl Sulfate (SDS), and Bovine Serum Albumine (BSA) are used in this study. The details of each material will be explained below.

Triton X-100 was purchased from Alfa Aesar Company (Germany). It is a non-ionic surfactant with molar mass 420 g/mol and the value of CMC is 0.25 mM [5].

SLES was purchased from Thor Company. It is an anionic surfactant which mostly used in industry, with a high foaming power and easy to rinse. Molar mass of SLES is 420 g/mol and its CMC value is 0.5 mM [6].

SDS was purchased from Merck (Germany). It has similar molecular structure than SLES and they are both anionic surfactants. The only difference is SLES has ethylene oxide units spacing the hydrophilic and hydrophobic parts. The molar mass of SDS is 288.4 g/mol and its CMC value is 8.5 mM [7].

BSA, which was purchased from Amresco, is sensitive to temperature. The molar mass of BSA is 66400 g/mol and its CAC value is 0.0004 mM [8].

B. Methods

Bubble Pressure Dynamic Method. This method consists in determining the maximum pressure which could be obtained during the formation of inert gas bubbles (nitrogen) at the end of a capillary of radius 0.377 mm immersed to a depth 10 mm in the liquid studied. By using a maximum bubble pressure tensiometry (Kruss BP2), the surface tension dynamic can be obtained and it is used for measuring the decreased of surface tension for very short times (20 ms – 10000 ms)[9].

Bikerman Method. This method consists in generating foam in a column already containing the solution (20 mL), by injecting a constant flow of nitrogen through a sintered-glass filter producing small bubbles for 30 s and the height of foam was noted for 5 minutes. The foam formed accumulates in the column and its volume increases for 30 s. After some time, the foam of the top begins to break. The height of foam and solution obtained gives an index that combines stability and foamability [10]

RESULT AND DISCUSSION

The value of CMC for each surfactant has been verified and they have similar CMC value than the

ones published in the literature. BSA needs more time to reach equilibrium conditions because of its complex structure, about 1800s compared to 300s for small surfactant molecules.

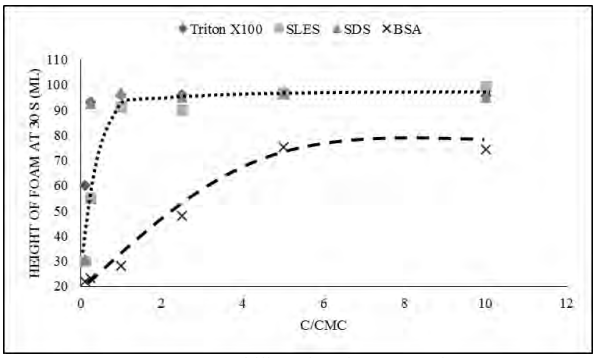

Figure 1. Foamability of surfactants and BSA.

From Figure 1, we observe that the foam height obtained after 30s reaches its maximum value slightly before the CMC and remains constant for higher concentrations. Contrarily, BSA shows a different result, as a concentration of about 5 times the CMC is needed in order to reach maximum foam formation.

Figure 2 shows a diminution of dynamic surface tension with increasing of surfactant concentration, which reaches a constant surface tension at the CMC. In contrary, protein shows only a very little decrease of surface tension while the foam formation increases. However, the foam of BSA is not stable and breaks easily. Further work will involve the study of mixtures to better control the foamability of industrial products.

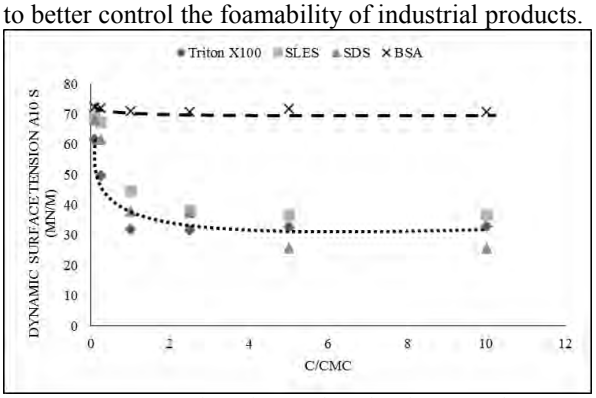

Figure2. Dynamic surface tension of surfactants and BSA.

REFERENCES

[1] L. Fameau, *"Acides gras : tensioactifs verts et propriétés moussantes originales,"* Techniques de l'inginéur, 2012.

[2] Beneventi, B. Carre et A. Gandini, *"Role of surfactant structure and foaming properties,"* Colloids and Surfaces A: Physicochemical and Engineering Aspects, vol. 189, pp. 65-73, 2001.

[3] Larpent, *"Tensioactifs,"* Techniques de l'Ingénieur, 1995.

[4] M. A. Masuelli, *"Study of Bovine Serum Albumin Solubility in Aqueous Solutions by Intrinsic Viscosity Measurements,"* Hindawi Publishing Corporation, vol. 2013, 2013.

[5] V. Fainerman, S. Lylyk et E. A. e. al, *"Adsorption layer characteristics of Triton surfactants 1. Surface tension and adsorption isotherms,"* Colloids and Surfaces A: Physicochemical and Engineering Aspects, vol. 334, pp. 1-7, 2009.

[6] L. Hamouz, *"Effect of Surfactant Concentration and Operating Temperature on the Drop Size Distribution of Silicon Oil Water Dispersion,"* Journal of Dispersion Science and Technology, vol. 28, pp. 79-84, 2007.

[7] M. A. Bahri, M. Hoebeke et A. G. e. al, *"Investigation of SDS, DTAB, and CTAB micelle microviscosities by electron spin resonance,"* Colloids and Surfaces A: Physicochemical and Engineering Aspects, vol. 334, pp. 1-7, 2009.

[8] M. Krzan, H. Caps et N. Vandewalle, *"High Stability of the bovine serum albumine foams evidenced in Hele Shaw Cell,"* Colloids and Surfaces A: Physicochemical and Engineering Aspects, vol. 438, pp. 112-118, 2013.

[9] V. Fainerman et R. Miller, *"Maximum bubble pressure tensiometry - an analysis of experimental constraints,"* Advances in Colloid and Interface Science, Vols. 1 sur 2108-109, pp. 287-301, 2004.

[10] J.-L. Salager et L. Choplin, *"Mousses - Formation, formulation et propriétés,"* Techniques de l'ingénieur, 2008.

Prediction of Ternary Vapor-Liquid Equilibria for Alcohols + Glycerol + Water Systems to Enhance the Quality of Glycerol as Biodiesel Side Product

Eviana D. Setiawati[1], Asalil Mustain[1], Gede Wibawa[1]

Abstract – Fossil fuels as the primary energy resources around the world cause significant negative effect on atmosphere. Recently, biodiesel, which primarily produced from renewable resources, has received great attention because of its environmental benefits. Higher chain of alcohols, such as butanol, may be used as solvent to produce biodiesel with glycerol as byproduct. In order to enhance the quality of glycerol as biodiesel side product which meets food and pharmaceutical standards, vapor-liquid equilibria (VLE) data for ternary systems consisting of 1-butanol, 2-methyl-1-propanol, glycerol and water are required to design and optimize the separation process of glycerol. In this work, the prediction of ternary VLE for (1-butanol / 2-methyl-1-propanol + glycerol + water) using UNIFAC model were determined at various temperatures and compositions and compared with the experimental data giving Average Absolute Deviations (AAD) less than 5.7%. The results indicated that UNIFAC was a reliable model for phase equilibria predictions in the mixtures containing of glycerol.

Index Terms – Vapor-liquid equilibria, 1-butanol, 2-methyl-1-propanol, glycerol, water.

INTRODUCTION

Biodiesel, which produced from vegetable oil, is considered to be a possible fuel for the future. It has received a great attention recently because of its environmental benefits, such as biodegradable, non-toxic, renewable and has reduced emission of CO, SO2, particulate matter [1].

Biodiesel fuel is mainly derived from transesterification process by alcohols and produced glycerol as a side product. Glycerol has several different potential uses in medical, pharmaceutical (drugs) and personal care preparations (cosmetics and toothpastes), tobacco and food processing (as a food additive, solvent, sweetener or a component of food packaging materials) and as a raw material in different chemical industries [2, 3].

Thus, distillation is an important process in related industries in order to separate glycerol which meets the food and pharmaceutical grade standards. Many data consisting of glycerol for binary and ternary VLE systems have been published, but there are just a few reports in the literature regarding to VLE data of related systems. For example, VLE data consisting of short-chain alcohols have been mostly reported in the literature.

VLE data were predicted by UNIQUAC Functional-group Activity Coefficients (UNIFAC) model [4] The calculated results were compared with the experimental data to observe the performance of UNIFAC model in predicting VLE for the systems consisting of glycerol as a side product in the biodiesel production.

MATERIAL AND METHOD

The materials used in this study, 1-butanol, 2-methyl-1-propanol, and glycerol, were supplied by Merck with minimum mass fraction purity of 0.995, 0.990, and 0.995, respectively. Table 1 shows the sources and the pure component properties used in the measurements. In this study, the vapor pressures were measured using a simple quasi-static ebulliometer as proposed previously in our previous work [5, 6].

RESULT AND DISCUSSION

The R_k and Q_k parameters of the UNIFAC groups for each component and interaction parameters between the existing UNIFAC main groups used in this study are taken from [7]. In this study, the VLE data (P-T-xi) for ternary systems of 1-butanol + glycerol + water at the temperatures of (303.15 to 343.15) K and 2-methyl-1-propanol + glycerol + water at the temperatures of (303.15 K to 333.15) K, respectively, have been measured. Before measured the VLE data, it is necessary to understand the region of total miscibility of such compounds to avoid the formation of two-layer phase. For this purpose, the concentrations of alcohols-water in binary liquid solutions reported by Fischer and Gmehling [8] were used as the basis to introduce the liquid mixtures of ternary systems.

Table 1 summarizes the comparison results between the experimental data with the prediction values of UNIFAC method. Considering the simplicity of the model, it is demonstrated that UNIFAC can describe very well the VLE consisting of alcohols, glycerol, and water mixtures as the average absolute deviation (AAD) in the vapor pressure less than 5.7%. The development of reliable predictive models would be useful for design, simulation and optimization of various separation processes in biodiesel or related compounds industries.

Both the experimental data and prediction values indicated that the vapor pressures increase with the

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increasing of alcohols alkyl chain length and temperatures.

Table 1. Absolute Average Deviation (AAD) in Vapor Pressures Resulting from the Prediction of VLE Using UNIFAC Method

System	*T* (K)	*n*[a]	AAD[a]
1-butanol + glycerol + water	(303.15 to 343.15)	90	4.3%
2-methyl-1-propanol + glycerol +water	(303.15 to 333.15)	98	5.7%

[a] $AAD = (1/n)\sum_{i=1}^{n} \left| \left(P_{cal} - P_{\exp}\right) / P_{\exp} \right|_i .100\%$, where n is the number of data points.

As illustration for several compositions, Figure 1 presents the comparison of VLE experimental data and UNIFAC predictions for the ternary systems of 1-butanol + glycerol + water and 2-methyl-1-propanol + glycerol + water, respectively. As presented, the UNIFAC predictions model is agree fairly well with the experimental data.

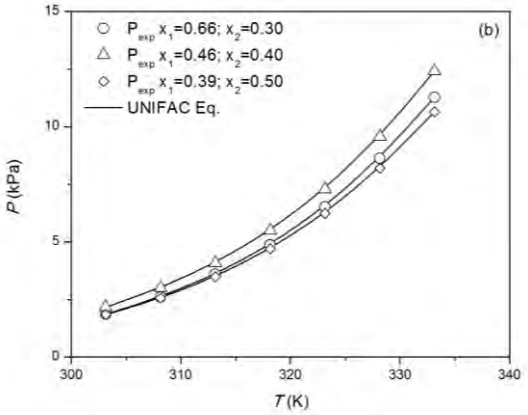

Figure 1. VLE Phase (P-T) Diagram for Ternary Systems:(a) 1-Butanol(1)+Glycerol(2)+Water(3); and(b) 2-Methyl-1-Propanol (1)+Glycerol(2)+Water (3)

CONCLUSION

The results indicated that the UNIFAC model was able to predict the VLE for the mixtures containing of glycerol with high accuracy to that obtained from experimental data. In the near future, group interaction parameters for UNIFAC structural groups in glycerol can be used to further extend the range of applicability of the UNIFAC model.

ACKNOWLEDGEMENTS

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REFERENCES

[1] S. T. Keera, et al., "Transesterification of vegetable oil to biodiesel fuel using alkaline catalyst," *Fuel*, vol. 90, pp. 42-47, 2011.

[2] M. B. Oliveira, et al., "Phase equilibria of glycerol containing systems and their description with the Cubic-Plus-Association (CPA) Equation of State," *Fluid Phase Equilibria*, vol. 280, pp. 22-29, 2009.

[3] C. A. G. Quispe, et al., "Glycerol: Production, consumption, prices, characterization and new trends in combustion," *Renewable and Sustainable Energy Reviews*, vol. 27, pp. 475-493, 2013.

[4] A. Fredenslund, et al., "Group-contribution estimation of activity coefficients in nonideal liquid mixtures," *AIChE Journal*, vol. 21, pp. 1086-1099, 1975.

[5] R. Oktavian, et al., "Vapor pressure measurements of ethanol–isooctane and 1-butanol–isooctane systems using a new ebulliometer," *Fuel*, vol. 107, pp. 47-51, 2013.

[6] G. Wibawa, et al., "Isothermal vapor–liquid equilibrium of ethanol + glycerol and 2-propanol + glycerol at different temperatures," *Journal of Chemical & Engineering Data*, vol. 60, pp. 955-959, 2015.

[7] H. K. Hansen, et al., "Vapor-liquid equilibria by UNIFAC group contribution. 5. Revision and extension," *Industrial & Engineering Chemistry Research*, vol. 30, pp. 2352-2355, 1991.

[8] K. FischerJ. Gmehling, "P-x and gamma infin. data for the different binary butanol-water systems at 50 degree.C," *Journal of Chemical & Engineering Data*, vol. 39, pp. 309-315, 1994 (GSTAR) Model and Its Properties," The 5th International Conference on Research and Education in Mathematics, 2008.

Energy Profile of Faster-than-Light Particles : A New Approach to The Special Theory of Relativity

Matradji[1], Tutug Dhanardono[1], Heri Justiono[1]

Abstract – It is known that neutrinos propagate faster than light. For that reason the Einstein's special theory of relativity cannot be applied to these phenomena. On the other hand the Matscie's special theory of relativity based on the Matscie's transformation is valid for any velocity including the velocities greater than the velocity of light in free space. The relativistic phenomena consisting of the length contraction and the time dilation can be verified successfully by the Matscie's special theory of relativity. In this case, the velocity of light in free space acts as the critical velocity. Only about 81.6% of the rest mass of a body can be converted into energy. At very low velocities, the kinetic energy of a moving body is practically the same as that in the classical mechanics. And also at velocities of much higher than the critical velocity, it almost reduces to the classical expression. For moderate velocities, the Matscie's special theory of relativity reduces to the Einstein's special theory of relativity. For velocities close to (below or above) the velocity of light in free space, the kinetic energy of a moving body differs from that predicted by the classical mechanics.

Index Terms – Critical Velocity, Length Contraction, Rest Mass, Time Dilation.

INTRODUCTION

It is known that neutrinos propagate faster than light. But the Lorentz transformations cannot be applied to the faster-than-light particles. Thus it is required to develop a new transformation applicable to the aforesaid scientific fact . In this case the Matscie's transformations hold for any velocities including the velocities greater than the critical velocity. These transformations still maintain the first and the second postulates of special relativity. The first postulate of special relativity states that the laws of physics may expressed in equations having the same form in all frames of reference moving at constant velocity with respect to one another. While the second postulate states that the speed of light in free space has the same value for all observers. In developing the Matscie's transformations it is introduced the so-called relativistic relative velocity between object and light.

RESULT AND DISCUSSION

The Relativistic phenomena

Based on the Matscie's transformations, the length contraction is formulated as

$$L_o = kL \tag{1}$$

where $k = k_\alpha$ for $v \le v_\alpha$, $k = k_\beta$ for $v \ge v_\beta$, and $k = k_c$ for $v_\alpha < v < v_\beta$. In this case L_o is the length of a body at rest and L is the length of the body at velocity v.

To verify this phenomena, consider the μ mesons traveling at speed $2.994 \times 10^8 m/sec$. The μ mesons are created high in the sky by fast cosmic-ray particles arriving at the earth from space, and reach sea level in profusion. The distance in which the mesons can travel during $t_o = 2 \times 10^{-6} sec$, the meson's mean lifetime, is presented in table 1. It is seen from this table, that the prediction by the Matscie's special theory of relativity is the most reasonable.

Table 1. The distance in which the mesons can travel during their mean lifetime

Prediction by	Distance
Newtonian mechanics	0.6 km
Einstein's special theory of relativity	9.5 km
Matscie's special theory of relativity	300 km

The time dilation phenomena according to the Matscie's transformations is formulated as

$$t = kt_o \tag{2}$$

where t_o is the time according to observer at rest and t is the time as measured by a moving observer at speed v. To verify this phenomena consider the following information written in the Holy Koran. The first information is implied in Al-Maarij 4 of the Holy Koran: "To the God Allah, angel and spirit went up for one day which equivalent to fifty thousand years". This is a time dilation phenomena informed by the Holy Koran in the sixth century. In this case $t/t_o = 50{,}000 \ \ years/1\ day = 18{,}250{,}000$. The second information is inserted in As-Sajdah 5 of the Holy Koran: "The God Allah arranged business from heavens to earth, and then it went up to the God for one day which equivalent to one thousand years according to your count". This is also a time dilation phenomena. But in this case $t/t_o = 1{,}000 years/1\ day = 365{,}000$. These informations are included in the following table.

Table 2. The time dilation phenomena [2]

$\frac{v}{c}$	$\frac{t}{t_o} = k$		$\frac{c}{v}$	$\frac{t}{t_o} = k_\beta$
	Einstein	**Matscie**		
0.9	2.29	9.1	0.9	10.1
0.999	22.37	999	0.999	1000.001
0.999 999	707.11	999 998.5	0.999 999	999 999.5
0.999 999 999	223 60.68	999 999 998.5	0.999 999 999	999 999 999.5

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Clearly from table 2, that the Einstein's special theory of relativity fails to provide the value of t/t_o as required. On the other hand the Matscie's special theory of relativity succeeds to find the values.

A. The Profile of Energy

For $v < c$ the kinetic energy T of a moving body is expressed as

$$T = E - E_o \tag{4}$$

where

$$E = m_o c^2 \begin{bmatrix} \alpha k_\alpha + \frac{1}{2}\ln\{1-(2+\sqrt{3})\alpha^*\} \\ + \frac{\frac{\sqrt{3}}{4}}{1-\alpha^*} + \frac{3}{8}\ln(1-\alpha^*) - \frac{1}{8}\ln(1+\alpha^*) \end{bmatrix} \tag{5}$$

$$\alpha^* = \frac{2\alpha-1}{\sqrt{3}+\sqrt{3+(2\alpha-1)^2}} \tag{6}$$

and

$$E_o = m_o c^2 \begin{bmatrix} \frac{\sqrt{3}+1}{8} + \frac{1}{2}\ln 2 \\ + \frac{3}{8}\ln(3-\sqrt{3}) - \frac{1}{8}\ln(\sqrt{3}-1) \end{bmatrix} \tag{7}$$

or approximately

$$E_o \approx 0.816 m_o c^2 \tag{8}$$

If E is interpreted as the total energy of the body, it follows that, when the body is at rest and $T = 0$, it nevertheless possesses the energy E_o. Accordingly E_o is called the rest energy of a body whose mass at rest is m_o. It can be interpreted that only about 81.6% of the rest mass of a body that can be converted into energy. This prediction differs from that of the Einstein's special theory of relativity which states that all of the rest mass m_o can be converted into energy, that is $E_o = m_o c^2$.

If $V \ll c$ then

$$T \approx \left(\frac{3}{4} - \frac{1}{8}\sqrt{3}\right) m_o c^2 \approx 0.533 m_o c^2 \tag{9}$$

Hence at low speeds the Matscie's relativistic expression for the kinetic energy of a moving particle reduces to the classical one. The kinetic energy T at $v = c$ is [4]

$$T = 999\,999\,987.6\, m_o c^2 \tag{10}$$

Thus the total energy of the body at the critical velocity is

$$E = 999\,999\,988.4\, m_o c^2 \tag{11}$$

The kinetic energy of the body at velocities greater than the critical velocity is expressed as

$$T = 1\,000\,000\,030\, m_o c^2 + \frac{k_\beta}{\beta} m_o c^2 - 2\sqrt{3} m_o c^2 \times \begin{bmatrix} \frac{1-\frac{1}{2}\sqrt{3}}{\beta^*+2-\sqrt{3}} - \frac{1}{8}\sqrt{3}\ln(\beta^*+2-\sqrt{3}) \\ -\frac{1}{24}\sqrt{3}\ln(2+\sqrt{3}-\beta^*) + \frac{1}{6}\sqrt{3}\ln(2-\sqrt{3}-\beta^*) \end{bmatrix} \tag{12}$$

where,

$$\beta^* = \frac{2\beta-1}{\sqrt{3}+\sqrt{3+(2\beta-1)^2}} \tag{13}$$

For very large v or $v \gg c$ then equation (12) becomes

$$T = 2 m_o v^2 - 1\,928\,203\,276\, m_o c^2 \tag{14}$$

This expression is valid only for v be much higher than 31 049.986 12 c. The first term on the right side of equation (31) indicate that at very high speeds, namely $\gg c$, the Matscie's relativistic expression for the kinetic energy of a moving particle reduces almost to the classical one. While the second term on the right side of the equation acts as a correction to make the kinetic energy expression closer to the classical one.

REFERENCES

[1] Beiser, *Perspectives of modern physics*, McGraw-Hill Kogakusha, Ltd., Tokyo, 1969.

[2] A. Beiser , *Concepts of modern physics*, 3rd edition, McGraw-Hill Kogakusha Ltd., Tokyo, 1981.

Fault Diagnosis of Rotating Machinery based on Acoustic Emission using PARAFAC-Source Separation

Anindita Adikaputri Vinaya[1], Dhany Arifianto[1]

Abstract – A common technique of vibration spectrum analysis is used for fault diagnosis of rotating machine in industry. The technique, however, requires a significant man power and has the risk of the direct measurement of vibration signal. This paper presents a remote maintenance technique based on acoustic emission of rotating machinery. The mixing matrix and the source signals are estimated using PARAFAC source separation by performing PARAFAC decomposition algorithm, permutation, and capon beamforming. This proposed technique prove the suitability and effectiveness of acoustic emission technique to diagnose Ball Pass Frequency of The Outer Race (BPFO) defect and misalignment coupling motor to pump.

Index Terms – Vapor-liquid equilibria, 1-butanol, 2-methyl-1-propanol, glycerol, water.

INTRODUCTION

Rotating machine is an important component in the industry. Fault diagnosis of rotating machine is a great importance. Vibration spectrum analysis is commonly used in the industry for fault diagnosis of machinery. [1]. However, the technique requires a significant man power and has the risk because of the direct measurement of vibration signal. On the other hand, the rotating machine has an acoustic emission. Vibration and acoustic signals have the same parameters such as amplitude, phase and frequency. In order to minimize the risk of direct measurement, diagnosis technique using acoustic emissions in rotating machine need to be developed.

The defect in rotating machine is known based on the instantaneous frequency when a machine is running [2]. And misalignment defects can be caused due to an error manufacturing, inadequate installation, and lack of lubrication. Many cases of bearing fault was found in the motor on the outer race [3]. Misalignment defect can be found in severe place in rotating machinery such as when pump and motor are coupled. When the defect is misalignment because of coupling, it can be diagnosed by the appearance of the first three harmonics [3].

In the real plant, there are many machines that will emit sound mixed with each other and accompanied by the presence of background noise. Therefore, in order to obtain the signal from the machine required signal processing to separate the mixed signals into its components. Blind Source Separation (BSS) is a method used to separate the mixture of signals without knowing much information about the signal sources and mixing processes [4-5].

In order to solve separating problems, Nion in 2010 used Parallel Factor (PARAFAC) decomposition to reduce the complexity of JAD algorithm. This method has good performance in solving problems related to the separation of the speech signal [7]. This study aims to determine the performance of PARAFAC-source separation method in separating the mixture. The sound signal is mixed in convolutive mixing in PLTU Unit 6 Paiton, East Java. The outlook of this study is technique can be used as consideration for detecting the condition of the machinery.

MATERIAL AND METHOD

PARAFAC was introduced in 1970 and widely used for wireless communication, sensor processing, food technology and BSS. PARAFAC decomposition based on multiway analysis with trilinear model which is the expansion of Principal Component Analysis (PCA) method used bilinear models. This model modifies a mixed signal x to the rank of three-way matrix [6]. In this study, we want to separate the mixture using PARAFAC-source separation with Capon beamforming algorithm. It is based on cross reduction in underdetermined case [6]. For more details, here are the steps of the process of separating mixed signals with PARAFAC-source separation:

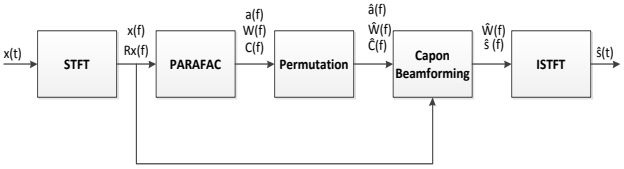

Figure 1. Separating process using PARAFAC-source separation

In order to verify the effectiveness of the proposed method, we conducted experiments designed to separate four major machine parts of rotating machine: motor drive-end (s1), motor nondrive-end (s2), pump drive-end (s3), pump nondrive-end (s4) with three microphones in a power plant PLTU Paiton unit 5.

RESULT AND DISCUSSION

After separating, the signals in time domain will be transformed in frequency domain for detecting faults. The signals also will be compared with vibration signals.

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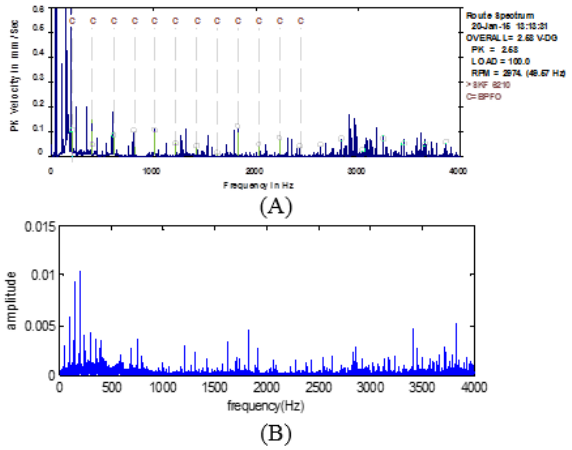

Figure 2. BPFO defect in motor non drive end based on vibration spectrum (a) and estimated signal (b)

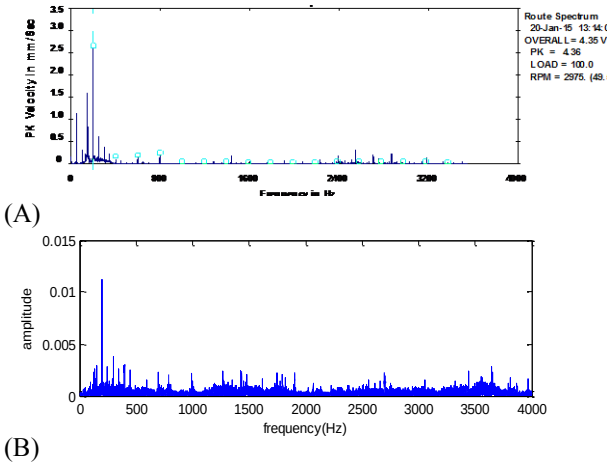

Figure 3. Misalignment defect in pump non drive end based on vibration spectrum (a) and estimated signal (b)

Based on figure 3 and 4, there are bearing and misalignment defects. Ball Pass Frequency of The Outer Race (BPFO) can be seen where there is vibration and acoustic signal harmonics marked with dashed lines along frequencies as shown in figure 3. Misalignment can be identified from the appearance of 3 harmonics at low frequencies as shown in figure 4. It is in accordance with the analysis of the defect characteristics to the machine [3].

The comparison of dominant frequency between the vibration signal and an acoustic signal estimation can be seen in Table 1. Based on table 1, PARAFAC method can separate mixed signals with minimal error is 0.014% on the estimated signal 3.

Table 1. Frequency instantaneous comparison in vibration and estimated acoustic signal

Source	Frequency Instantaneous(Hz)		Error
	Vibration Signal	Estimated Signal	
s1	203.01	198.53	2.21%
s2	202.55	198.59	1.95%
s3	198.62	198.59	0.014%
s4	198.30	198.59	0.14%

CONCLUSION

Separation of mixed signals on the pump has been conducted using tensor decomposition PARAFAC model in power plant PLTU Paiton unit 5. The separation using tensor decomposition methods with PARAFAC model has compatibility with vibration analysis, so that they can be used to diagnose machinery defects. The pattern of sound signal can be characterized by a dominant frequency or instantaneous frequency, and the signal spectrum. Based on the results that have been obtained, the machine has ball pass frequency of the outer race (BPFO) defect and misalignment coupling motor to pump.

REFERENCES

[1] Scott, I. G.. *Basic Acoustic Emission*, Gordon and Breach, New York. 1991.

[2] Atmaja, B. T., and D. Arifianto. "Machinery fault diagnosis using independent component analysis (ICA) and Instantaneous Frequency (IF)." Instrumentation, Communications, Information Technology, and Biomedical Engineering (ICICI-BME), 2009 International Conference on. IEEE, 2009.

[3] Felten, Dave. "Understanding bearing vibration frequencies." Electrical Apparatus Service Association (EASA), St. Louis, MO, 2003.

[4] Reju, VG., Ngee, Soo dan Yang,In. (2009). "An Algorithm for Mixing Matrix Estimation in Instantaneous Blind Source Separation", Signal Processing 89, pp.1762 –1773.

[5] Bofill,P dan Zibulevsk.(2001). "Underdetermined Blind Source Separation Using Sparse Representations", Signal Process., vol. 81, no. 11, pp.2353–2362.

[6] Nion, Dimitri. (2010). "Batch and Adaptive PARAFAC-Based Blind Separation of Convolutive Speech Mixtures". IEEE Transactions On Audio, Speech, And Language Processing, Vol. 18, No. 6.

Vibration Effect on the SMS Fiber Structure

Ika Puspita[1], Ayu Kusumawardhani[1], Sekartedjo[1], A. M. Hatta[1]

Abstract – We present a preliminary result on the singlemode-multimode-singlemode (SMS) fiber structure for a vibration sensor. The SMS fiber structure was placed in a macrobender within the mechanical transducer to detect the frequency of a vibration source. The time series of optical output power of the SMS fiber structure was measured and it was transformed into the frequency domain using the fast Fourier transform. It was demonstrated that the frequency of vibration source can be determined by using the mechanical transducer with the SMS fiber structure. It was also analyzed the distance effect between the source and the SMS fiber structure. It was shown that the frequency measurement of 20 Hz vibration source can be carried out in a range of 0 to 30 cm with an error frequency 0.1 Hz. This scheme is potential for the vibration measurement which offers inexpensive and simple configuration.

Index Terms – SMS fiber structure, macrobending, vibration effect.

INTRODUCTION

SMS fiber structure has been utilized for many applications such as strain sensor, load sensor, temperature sensor, and refractometer [1-4]. In this paper, the SMS fiber structure is proposed for an application of vibration measurement.

MATERIAL AND METHOD

Figure 1 shows a schematic diagram of the vibration measurement using the SMS fiber structure within the mechanical transducer. A macrobending technique was utilized to. The SMS fiber structure made of multimode graded index fiber which has core/cladding diameter of 62.5/125 μm, splice between two identical standard singlemode fiber (shown in Fig. 2). The vibration source is a water pump which has a vibration frequency of 20 Hz. The vibration source was set in distances of 20 cm, 30 cm and 40 cm from the SMS fiber structure. The vibration source produces acoustic emission and it would vibrate the mechanical transducer. This vibration will modulate the output power of SMS fiber structure. An intensity measurement scheme was employed by connecting the SMS fiber structure's both ends to a laser source of 1550 nm wavelength and an optical power meter. A computer was used to record the change of output power.

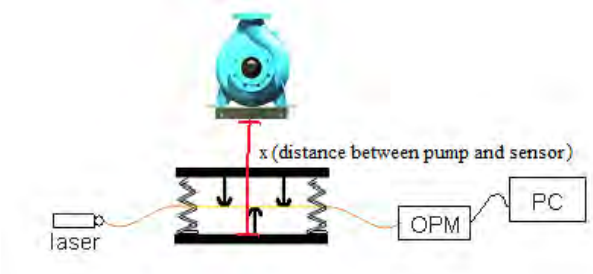

Figure 1. A schematic diagram of vibration measurement using the SMS fiber structure and a mechanical transducer

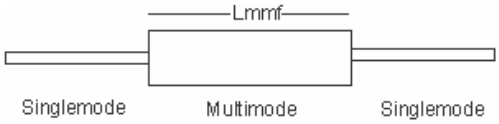

Figure 2. SMS fiber structure.

RESULT

Figure 3 shows the time series of optical output power of SMS fiber structure for a distance of 20 cm between the vibration source and the SMS fiber structure. The time series of output power was converted into the frequency domain using a fast Fourier transform. It is shown in Fig. 4 the corresponding frequency of 20 Hz from the time series of output power as in Fig. 3.

The measurement distance between the vibration source and the SMS fiber was varied. Figure 5 shows the error frequency as a function of the measurement distance. One can see the error frequency is about 0.1 Hz at the distance of 30 cm, and larger error for the greater distance.

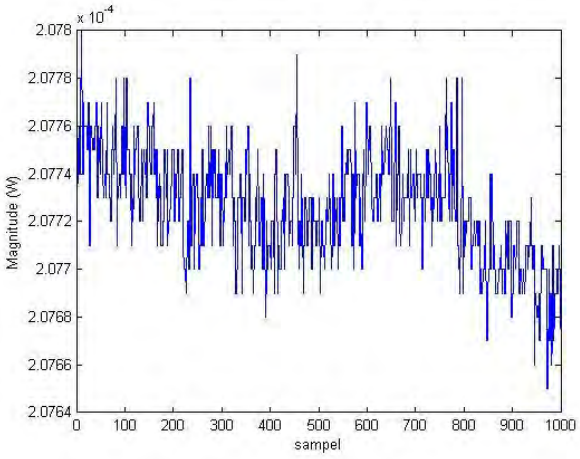

Figure 3. Output power signal of SMS fiber structure was recorded in 20 cm distance.

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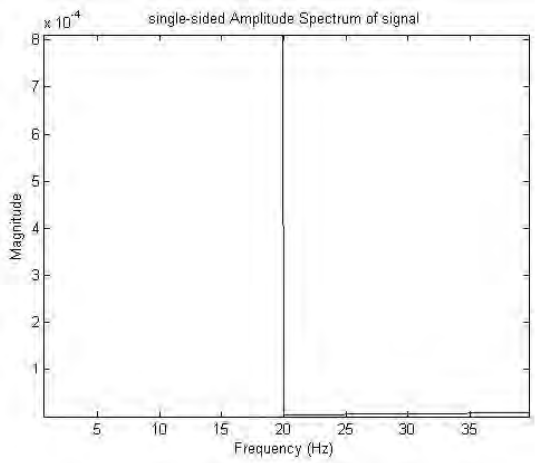

Figure 4. FFT result of the signal from Figure 2.

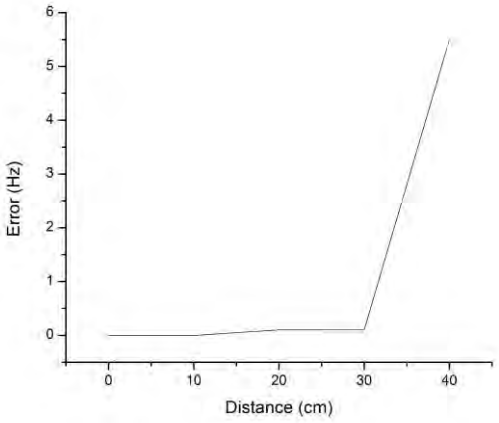

Figure 5. Error of vibration frequency measurement as a function of measurement distance.

CONCLUSION

The scheme of SMS fiber structure is potential for the vibration sensor which offers inexpensive and simple configuration. It was shown that the frequency measurement of 20 Hz vibration source can be carried out in a range of 0 to 30 cm with an error frequency 0.1 Hz.

REFERENCES

[1] M.Hatta, Y.Semenova, W.Qiang, G.Farrel. "Strain sensor based on a pair of singlemode–multimode–singlemode fiber structures in a ratiometric power measurement scheme". *Applied Optics Vol. 49*. 2010.

[2] R.B.Kuntaraco, Sekartedjo, AM.Hatta. *Pengembangan Metode Pengukuran Beban Menggunakan Serat Optik Berstruktur Singlemode-Multimode-Singlemode*. Master Thesis in Institut Teknologi Sepuluh Nopember. 2013.

[3] M.Kumar, A.Kumar, S.M.Tripathi. "A comparison of temperature sensing characteristics of SMS structures using step and graded index multimode fibers". *Optics Comm. 312 pp. 222-226*. 2014.

[4] Q. Wang, Y.Semenova, P.Wang, G.Farrel. "High Sensitivity SMS Fiber Structure Based Refractometer – Analysis and Experiment". *Optics Express, vol. 19, no. 9, pp. 7937-7944*. 2011.

[5] Bofill,P dan Zibulevsk.(2001). "Underdetermined Blind Source Separation Using Sparse Representations", Signal Process., vol. 81, no. 11, pp.2353–2362.

[6] Nion, Dimitri. (2010). "Batch and Adaptive PARAFAC-Based Blind Separation of Convolutive Speech Mixtures". IEEE Transactions On Audio, Speech, And Language Processing, Vol. 18, No. 6.

Study of The Correlation Between Contact Angle Values with The Polarity of Liquids

Muhammad Alwi Syahara[1], Fredy Kurniawan[1], Wahyu Anggriawan[1]

***Abstract* – Contact angle measurement is a technique which can be used to determine the surface properties of a substance and observe the interaction of surfaces. When polar liquid dropped on a non-polar solid, it will make an interaction that can observed from the contact angle. In simple way, the different polarity of the solid and the liquid sample will affect to the contact angle obtained. In this work the value of contact angle will be correlated to the polarity of the sample. The results showed that the plot between polarity parameter with contact angle on polytetrafluoroethylene substrat has a correlation which formed a sigmoidal curve with R^2=0,954. It means the polarity of liquids can be determined by the contact angle values.**

***Index Terms* – Contact angle measurement, polar molecule, polarity parameter, surface properties.**

INTRODUCTION

Contact angle (θ) is the angle between the solid surface and a liquid droplet surface intersection of the lines at the contact point between [1]. Contact angle can be defined in different ways; determining the angle of droplets through the goniometer telescope (sessile drop method), captive bubble method, tilting plate method, Wilhelmy balance method, and the capillary rise method [2]. Sessile drop method is the most popular determination of contact angle, the reason is because this method requires a fairly easy stage and less of liquids and solids [3]. Generally, Contact angle measurements can be used to determine the surface tension [4][5][6], but the contact angle measurements can also be used to study the properties of molecular interactions solids-liquid (ion-dipole, dipole-dipole, and Van der Waals forces) [5]. From the molecular interaction can be taken a hypotheses that contact angle can be related with polarity of liquids.

Determination of polarity can be defined in several ways; determination of the dipole moment and dielectric constant that require experimentation and mathematical calculation through Onsager equation [7] [8] and using the solvathochromic method that using dyes and resulting polarity parameter (E_T^N) [9] [10]. Both of the methods seems difficult and not simple to do, so we need a breakthrough that is easy to determine the polarity of liquids by using the contact angle measuring device.

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METHOD

A. *Preparation of Polymer Substrat*

Polymer Substrat (polytetrafluoroethylene) must first be washed with detergent and then sonicated for 30 minutes to clean the surfaces. Then substrat dried in oven at 45 ºC for 15 minutes. Polymer substrat stored in a desiccator for 6 hours before use.

B. *Contact Angle Measurement of Liquids*

Ten liquids with different polarity (E_T^N = ± 0 - 1) was used. Polymer substrat that has been prepared, placed in the goniometer and position of the subtrat adjusted to the appearance from each camera, then the liquid dripped by syringe 25µl. Droplets that appear on each camera will be photographed. Images obtained from the camera will be processed with the software ImageJ, and its contact angle is determined by the plugin Low Bond-Axisymmetric Drop Shape Analysis.

C. *Correlating Contact Angle Values with Polarity Parameter*

Results of contact angle measurements will be recorded and compared with the data of polarity parameter of liquids (E_T^N). The data obtained will be plotted to get contact angle as the function of polarity of liquid. From the plote will be drawn conclusions the relationship between contact angle and polarity parameter of liquids.

RESULT

The polymer substrat was succesfully prepared, it was cleaned and stored at desiccator. Image of the droplets was succesfully captured and the contact angle values was measured. The image showed that droplet form varying due to the polarity of liquids (Figure 1). The lower contact angle obtained was from n-hexane (E_T^N = 0,09) that is 0º and the higher contact angle obtained was from water (E_T^N = 1) that is 118º.

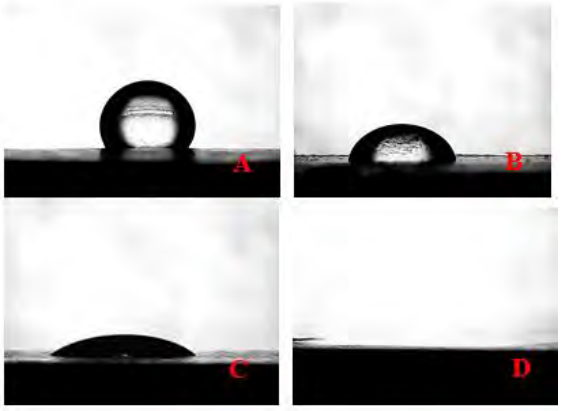

Figure 1. Image of liquids droplet, (A) droplet of water, (B) propylene glycol, (C) ethanol, (d) n-hexane.

The contact angle values that was obtained then compared with the data of polarity parameter (E_T^N) and plotted into a curve. The curve between the contact angle values and the liquids polarity parameter showed that it has a correlation. It formed a sigmoidal curve which R^2 is 0,954 that shown in Figure 2.

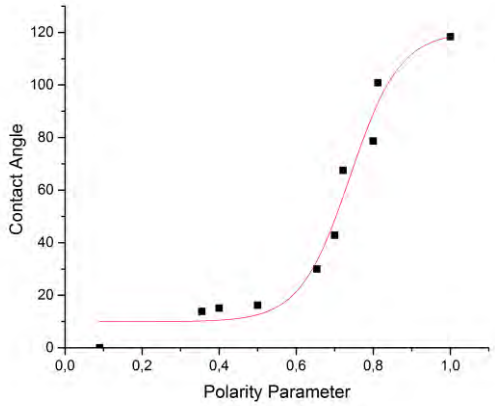

Figure 2. Graphic curve between contact angle (θ) values versus polarity parameter (E_T^N). Conclusion

The scheme of SMS fiber structure is potential for the vibration sensor which offers inexpensive and simple configuration. It was shown that the frequency measurement of 20 Hz vibration source can be carried out in a range of 0 to 30 cm with an error frequency 0.1 Hz.

CONCLUSION

From the result known that contact angle values has a correlation with polarity parameter. The correlation can imply that the polarity of liquid can be determined using contact angle values. So that, it can be improved to be a new method to determining polarity of liquid.

ACKNOWLEDGEMENTS

We acknowledge Ministry of Research Technology and Higher Education for the financial support. We also would like to thanks Instrumental and Analytical Sciences Laboratory of Institut Teknologi Sepuluh Nopember for providing contact angle measurement.

REFERENCES

[1] Dionísio, M., and Sotomayor, J., "A Surface Chemistry Experiment Using an Inexpensive Contact Angle Goniometer", *Journal Chemical Education,* vol. 77, no. 1, pp. 59, 2000.

[2] Yuan, Y., and Lee, T.R., "Contact Angle and Wetting Properties", in *Surface Science Techniques*, Bracco, G., Holst, B. (Eds.), Springer Series in Surface Sciences, pp. 3–34, 2013.

[3] Chini, S.F., and Amirfazli, A., "A method for measuring contact angle of asymmetric and symmetric drops", *Colloids Surface Physicochem. Eng. Asp*., vol 388, pp. 29–37, 2011.

[4] Li, D., and Neumann, A.W., "Contact angles on hydrophobic solid surfaces and their interpretation", *J. Colloid Interface Sci,* vol. 148, pp. 190–200, 1992.

[5] Kabza, K.G., et.al. "Contact Angle Goniometry as a Tool for Surface Tension Measurements of Solids, Using Zisman Plot Method. A Physical Chemistry Experiment", *J. Chemical Education,* vol 77, pp. 63, 2000.

[6] Soon, C.F., et.al., "A Bespoke Contact Angle Measurement Software and Experimental Setup for Determination of Surface Tension", *Procedia Technol., 4th International Conference on Electrical Engineering and Informatics, ICEEI* 2013 vol. 11, pp. 487–494, 2013.

[7] Makosz, J.J., "Dipole moment of molecules determined from dielectric measurements in very dilute solutions of a dipole liquid in a nondipole liquid", *Journal Molecule. Liquid,* vol. 59, pp. 103–113, 1994.

[8] Włodarska, M., "Dipole moment calculation in solution for some liquid crystalline molecules", *J. Molecule Structure*, vol. 1059, pp. 44–50, 2013.

[9] Reichardt, C., "Solvatochromic Dyes as Solvent Polarity Indicators", *Chemical Review*, vol. 94, pp. 2319–2358, 1994.

[10] Katritzky, et.al. "Quantitative Measures of Solvent Polarity", *Chemical Review,* vol. 104, pp. 175–198, 2004.

Design of Model Predictive Torque Control (MPTC) for Speed Control 3 Phase Induction Motor with Robust Stator Flux Observer

Halim Mudia[1], Mochammad Rameli[1], Rusdhianto Efendi[1]

Abstract – The induction motor is a desirable alternative to the direct current motor in many applications because it is rugged, reliable and economical. However, control of the induction motor is more complex than the direct current motor, this is caused by the complexity of the dynamics of the induction motor, so the algorithm of induction motor is more complex. Based on these problem, author conducted a study on the induction motor using Model Predictive Torque Control (MPTC) with robust stator flux observer, in which robust stator flux observer is designed to overcome the shortcomings in the Direct Torque Control (DTC) conventional which can cause high fluctuation in flux ripple and torque ripple when reach steady state condition. So from the purpose of the proposed method, the results of the designed system can adjust the rotating speed of the induction motor in accordance references given at 120 rad /s with a settling time is 0.753 seconds, and also can minimize fluctuations in flux ripple and torque.

Index Terms – Direct Torque Control, Induction Motor, Model Predictive Control, Robust Stator Flux Observer.

INTRODUCTION

In this research, the propose of design speed control of induction motor 3 phase is equipped with three main parts, controller (model predictive control and propotional-integral), direct torque control, robust stator flux observer, and induction motor model, depicted in Fig. 1.

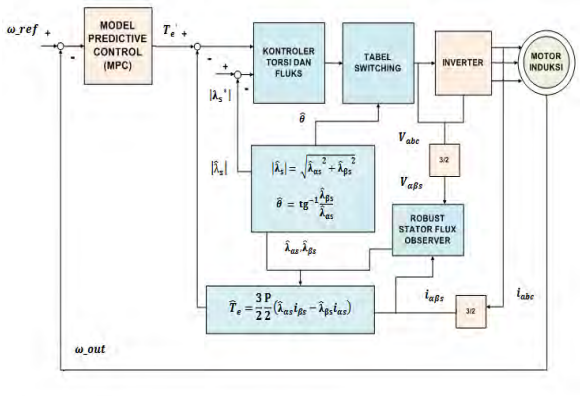

Figure 1. Block diagram of the system induction Motor.

Based on system induction model, the control strategy Single Input Single Output (SISO) is designed and realized with Model Predictive Torque Control (MPTC) with robust stator flux observer to control the speed of three phase induction motor using matlab, where robust stator flux observer can be designed with the following equation:

$$\hat{x}(k+1) = (A_n + \Delta A)\hat{x}(k) + Bu + H(\hat{\imath}_s(k) - i_s(k)) \quad (1)$$

$$\hat{\imath}_s(k) = c\hat{x}(k) \quad (2)$$

Where the mathematical model of the induction motor is expressed by:

$$\begin{bmatrix} V_{qs} \\ V_{ds} \\ V_{qr} \\ V_{dr} \end{bmatrix} = \begin{bmatrix} R_s + pL_s & \omega_e.L_s & pL_m & \omega_e.L_m \\ -\omega_e.L_s & R_s + pL_s & -\omega_e.L_m & pL_m \\ pL_m & (\omega_e - \omega_r)L_m & R_r + pL_r & (\omega_e - \omega_r)L_r \\ -(\omega_e - \omega_r)L_m & pL_m & -(\omega_e - \omega_r)L_r & R_r + pL_r \end{bmatrix} \begin{bmatrix} i_{qs} \\ i_{ds} \\ i_{qr} \\ i_{dr} \end{bmatrix} \quad (3)$$

The mathematical model of the induction motor load is expressed by the equation:

$$\tau_e - \left(\frac{N_1}{N_2}\right)^2 \left(B_b\omega_m + J_b\frac{d}{dt}\omega_m\right) - B_r\omega_m = J_r\frac{d}{dt}\omega_m \quad (4)$$

RESULT AND DISCUSSION

Results of design speed Control 3 phase induction motor with robust stator flux observer can be seen in the following figure:

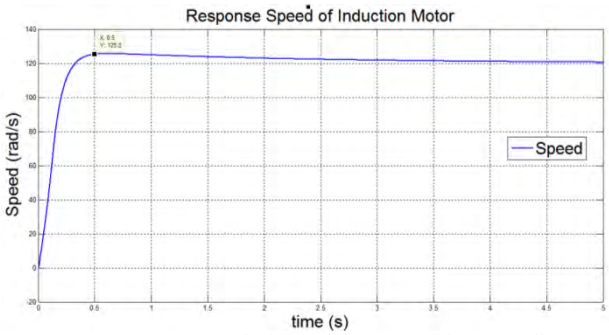

Figure 2. Response Speed of Induction Motor Using controller propotional-integral Direct Torque Control with load (Reference = 120 rad/s)

In figure 2, it can be seen that the value of the response speed by using a load at the time of t = 0.5 second is 125.2 rad /s

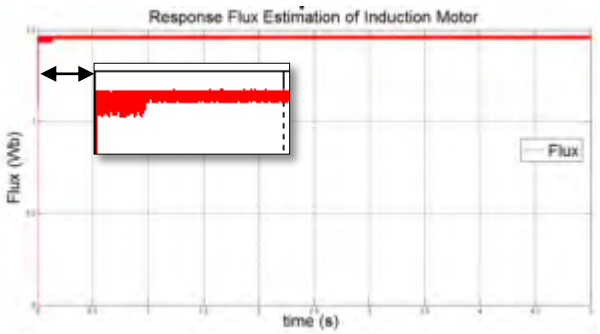

Figure 3. Response flux Estimation of Induction Motor Using controller propotional-integral Direct Torque Control with load

Based on the results in figure 3 and figure 5 that the Direct Torque Control (DTC) with robust stator flux observer can minimize ripple fluctuations flux in the steady state, and the results in figure 2 and figure 4

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that the model predictive control (MPC) can keep speed in accordance with the speed reference.

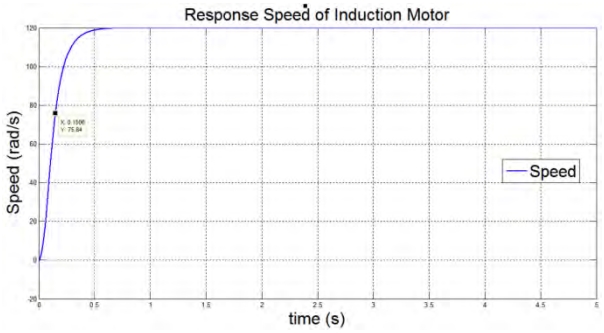

Figure 4. Response Speed of Induction Motor Using model predictive torque control robust stator flux observer With Load (Reference = 120 rad/s)

In figure 3, after using the Model Predictive Torque Control (MPTC) with robust stator flux observer, the response speed can reach the specified reference value of 120 rad/s with the value of the time constant (τ) to speed response in Figure 4.15 is 0.1506 seconds, and settling time obtained for 0.753 seconds.

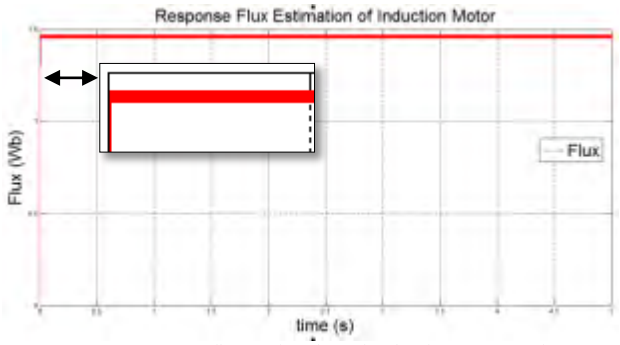

Figure 5. Response flux Estimation of Induction Motor Using model predictive torque control robust stator flux observer With Load.

REFERENCES

[1] Bose, K. B. "Modern Power Electronics and AC Drives", *Prentice Hall*, Knoxville, 2002.

[2] Ramesh, T., Panda, K. A. "Direct Flux and Torque Control of Three Phase Induction Motor Drive Using PI and Fuzzy Logic Controllers for Speed Controller for Regulator and Low Torque Ripple ". *Department of Electrical Engineering, National Institute of Technology*, India, 2012.

[3] Diab, Z. A. A., Pankratov, V. V. "Model Predictive Control of Vector controlled Induction Motor Drive", *IEEE* 2012 7th International Forum on *Strategic Technology (IFOST)*, Russia, 2012.

[4] Sun, D. "Sliding Mode Direct Torque Control for Induction Motor with Robust Stator Flux observer", *IEEE 2010 International Conference on Intelligent Computation Technology and Automation*, China, 2010.

Performance Test of Double Crossed Membrane Contactor for Simultaneous Absorption-Desorption Of CO_2 Using Diethanolamine

Yeni Rahmawati[1], Toto Iswanto[1], Muhammad Rifa'i[1]

Abstract – This study aimed to test the performance of polypropylene hollow fiber that were configured in the double crosses configuration as membrane contactor by combining absorption-desorption process simultaneously in one module using diethanolamine as solvent which is expected to separate CO_2 optimally by using of minimal solvents. The solvent allowed to stand in the shell module, feed gas supplied to the lumen of the first tube, and sweep gas flowed into the lumen of the second tube of membrane module. The experimental results showed that during the first three hours, the flux of absorption decreased until $2.63x10^{-5}$ mol/m^2.s and the efficiency of absorption decreased to 5.181%, whereas flux of desorption increased every hour until $6.202x10^{-5}$ mol/m^2.s during performance test, while the efficiency of desorption rose to 92.437%.

Index Terms – CO_2 separation, hollow fiber membrane contactor, polypropylene, simultaneous absorption-desorption.

INTRODUCTION

The research on membrane contactor using absorption-desorption process of CO_2 had most commonly done separately/hybrid, in which the absorption-desorption process by separate equipment requires a large enough circulation of solvent, so that when the use of expensive solvents will enhance the overall operational costs. Therefore, developed membrane contactors for absorption-desorption process of CO_2 simultaneously using a dual crosses of membrane contactor module.

The research on the crossed membrane contactor for absorption-desorption process of CO_2 simultaneously had done by Guha (1990), Kumazawa (2000), and Shimada (2006). However, these studies were still using small concentrations of CO_2 gas, which was 5-30% by volume, while the content of CO_2 gas in natural gas can reach 30-60% by volume such as in Natuna natural gas.

In this paper, the detailed study polypropylene hollow fiber that were configured in the double crosses configuration as membrane contactor by combining absorption-desorption process simultaneously in one module using DEA is reported. The concentration of CO_2 in sales gas and sweep gas out were investigated by Gas Chromatography (GC) analyzer. The flux and efficiency of absorption and desorption process of CO_2 were calculated by a formula.

MATERIAN AND METHOD

A. Material

In the present paper, a polypropylene (PP) hollow fiber membrane contactor were used to capture CO_2 in the feed gas (40% of CO_2 balanced with N_2). Diethanolamine (DEA) 30% of mass was role as CO_2 absorber and N_2 gas, 99.95% balanced with O_2 was role as sweep gas. Those gas are from PT. Aneka Gas Industry. The PP hollow fiber membrane has specification as following:

Table 1. Specification of hollow fiber membrane module

Parameters	Value
Module inner diameter (mm)	0.35
Module outer diameter (mm)	0.5
Pore size (μm)	0.2
Membrane fiber length (mm)	83
Number of fibers	2500
Number of layer	25
Contact area gas-liquid (m^2)	21.195
Fiber Porosity	0.65

B. Experimental Apparatus and Procedures

1) Determining the Best Operating Parameters

To know the best operating parameters value of feed gas and sweep gas flow rate, so investigation of flux and efficiency of absorption and desorption were firstly determined.

The solvent, DEA 30% of mass, was pumped through the bottom of the membrane module using pump 1.6 LPM (Deng Yuan Industry co., ltd, Taiwan) until all of membrane completely submerged. Then, feed gas (mix gas 40% CO_2 balanced with N_2**)** was introduced into the system from compressed gas cylinders and its flow rate was adjusted by rotameter (Dwyer Instrument. Inc.) that was set 400-800 ml/minute according to experiment variables, so do the sweep gas.

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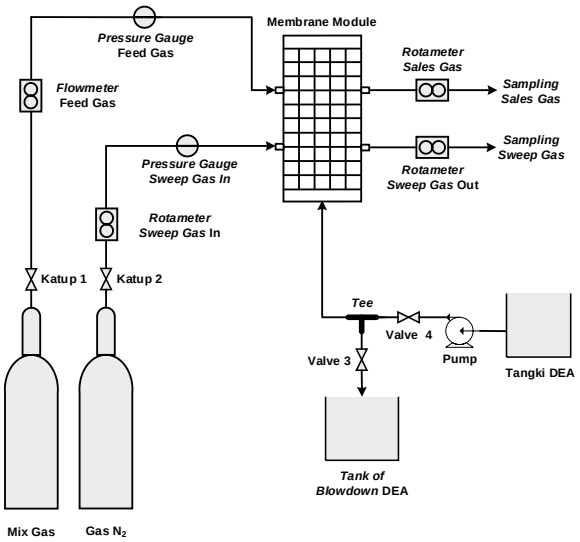

Figure 1. Schematic drawing of experimental setup

All data were collected at steady state, after at least 30 min of operating time. Steady state was indicated by constant CO_2 concentration in the outlet gas (sales and sweep gas) stream. All concentration of CO_2 had determined by GC analyzer. The value of absorption and desorption efficiency and mass transfer rate of CO_2 were calculated by equation (1) [1] and (2) [2] for absorption and equation (3) and (4) for desorption.

$$J_{CO_2(absorpsi)} = \frac{(Q_{in}\times C_{in} - Q_{out}\times C_{out}) \times 273{,}15}{0{,}0224\times T_g \times S} \quad (1)$$

$$\eta = \frac{Q_{in}\times C_{in} - Q_{out}\times C_{out}}{Q_{in}\times C_{in}} \times 100\% \quad (2)$$

$$J'_{CO_2} = \frac{(V_{out}\times K_{out}) \times 273{,}15}{0{,}0224\times T_g \times S} \quad (3)$$

$$\eta' = \frac{V_{out}\times K_{out}}{Q_{in}\times C_{in} - Q_{out}\times C_{out}} \times 100\% \quad (4)$$

From the maximum value of absorption and desorption efficiency and mass transfer rate of CO_2 in this part, flow rate 800 ml/min of mix gas and 400 ml/min of sweep gas were selected as the best of operating parameters value that will be used in long-term test performance of membrane module for 8 hours of operation time. Its procedures were almost same with procedure of determining the best operating parameter above. The differences were about their flowrate of mix and sweep gas.

RESULT

From Figure 2, it can be seen that the flux of desorption progressively increasing. This could be caused by solvents that became saturated with CO_2. The difference in CO_2 concentrations were large, the CO_2 in the solvent diffused into the sweep gas.

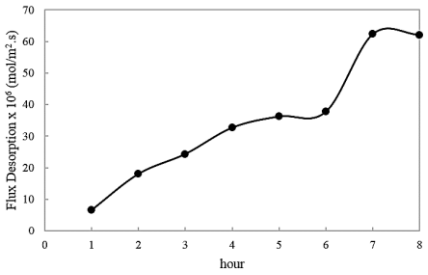

Figure 2. Flux of desorption for long-term performance of membrane contactor during 8 hours of operating time.

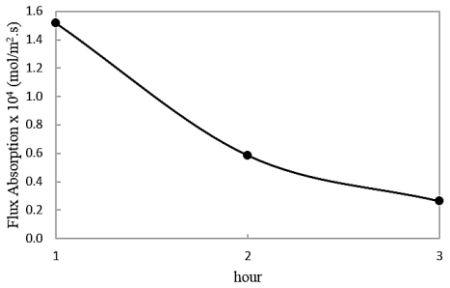

Figure 3. Flux of absorption for long-term performance of membrane contactor during 3 hours of operating time.

In the first three hours of the test performance, absorption flux progressively decreased, as shown in Figure 3. It could be caused by gas trapped in the membrane that was pushed out. CO_2 gas was trapped in the membrane indicates that the gas was not absorbed into the solvent. It could be caused by a solvent which began saturated or membrane surface that had been wet resulting membrane pores closed.

During the first three hours, the flux of absorption decreased until $2.63\text{x}10^{-5}$ mol/m^2.s and the efficiency of absorption decreased to 5.181%, whereas flux of desorption increased every hour until $6{,}202\text{x}10^{-5}$ mol/m^2.s during performance test, while the efficiency of desorption rose to 92.437%.

CONCLUSION

For overall, the membrane contactor was able to absorb and desorb CO_2 during the three-hour performance test.

REFERENCES

[1] Kumar, P.S., Hogendoorn, J.A., Feron, P.H.M., Versteeg, G.F. (2002). "New Absorption Liquids for the Removal of CO_2 from Dilute Gas Streams Using Membrane Contactor." *Journal of Chemical Engineering Science*, **57**, 1639-1651.

[2] Yeon, S.H., Sea, B., Park Y.I., Lee, K.S., Lee, K.H. "Application of pilot-scale membrane contactor hybrid system for removalof carbon dioxide from flue gas. JMembr Sci. 2005; 257: 156-60.

Effect of Sodium Hydroxide (NaOH) in Bitumen Separation Process from Asbuton in Hot Water

Afan Hamzah[1], Dita Ahmeta Ferdiansyah[1], Siti Nurkhamidah[1], Fadlilatul Taufany[1], Susianto[1]

Abstract – Hot water process is one of methods to separate bitumen from asbuton. For increasing %recovery of bitumen, we can modify the hot water process by adding diesel oil, sodium hydroxida (NaOH) and Sodium Ligno Sulfonat (SLS) as surfactant. This research was foccusing on effect of the addition of NaOH concentration. This research used asbuton from Kabungka and carried out in two processes, digestion and sedimentation process. % recoverey decreases with the increasing of NaOH concentration. The highest % recovery is 92% when ratio of diesel oil:asbuton 60:40, 0,5%wt SLS concentation, 30%wt SLS-NaOH solution from total solution and 1%wt NaOH concentration.

Index Terms –Hot water, asbuton, SLS, NaOH.

INTRODUCTION

Asbuton is natural aspalt which is contained in rock in Buton Island. Asbuton utilization as alternative material for petrolium aspalt had not maximized yet due to lack of effectiveness in separation of bitumen in many researches before. There were two metods to separate bitumen from asbuton based on the method to separate oil from Utah and Athabasca tar sand, they were extraction with organic solvent and hot water. Extraction with organic solvent is not preferable due to less economical. Whereas Hot water process is more economical.

Hot water process was invented by Clark (1920) used for separating bitumen from Athabasca oil sand. This process can not be used completely in bitumen-asbuton separation caused by the differences of impurities with Athabasca oil sand. Athabasca oil sand had Silica (SiO_2) impurities [1] and Asbuton contains calcium carbonate ($CaCO_3$) [2] impurities. Because $CaCO_3$ have higher solubility in water than SiO_2 , it is necessery to modify hot water process. One of its modification was the addition of surfactant and NaOH. Surfactant has function to decrease surface tension between bitumen and its impurities and NaOH utilized as sealing agent, prevent bitumen to repatch on impurities [4].

From the previous research, the main problem was the less of (%) recovery obtained due to low concentarion of NaOH added. Up until now, the highest NaOH concentration used was 0,05%wt. Meanwhile, Separation process bitumen from Utah tar sand was optimized in addition NaOH 0,58 M or about 2%wt concentration. The focus in this research was studying the effect of concentration of NaOH added to %recovery of bitumen.

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MATERIALS AND METHODS

Asbuton from Kabungka, NaOH (1%, 2%, 3%wt), SLS (0,5%wt), Diesel oil : Asbuton (60:40), hot water, Chloroform.

A. Content of Bitumen Analysis

300 gram asbuton was stored in oven at 105^0 C for 24 hours. Then soxhlet extraction (SNI 03-3640-1994 (BALITBANG-DINAS PU) was carried out to obtain the content of bitumen. After that calibration curve 1/ ρ vs bitumen concentration was made.

B. Digestion

Digestion process is carried out in a stirred cylindrical tank with 10,8 cm diameter and 20 cm height, which is equipped with a disc turbine stirrer and 4 baffles First step was started by mixing 300 gr asbuton with diesel oil: asbuton ratio 60:40 in stirred cylindrical tank in 250 rpm and 90^0C temperature for 30 minutes. Then, it was added by surfactant 30%, 35% and 40% (surfactant solution:asbuton-diesel oil) SLS-NaOH. The concentration of surfactan used was 0,5 (%wt) and for NaOH, 1%, 2% and 3% (%wt) was used. Digesting process was started after the solution of SLS-NaOH was added and it was stirred in 1500 rpm for 30 minutes.

C. Sedimentation and %recovery analysis

Sedimentation process was started by moved the mixture solution in beaker glass and it was added by 20%wt brine solution. After 24 hours sedimentation process, it form three layers. The top layer was bitumen solar solution. It was taken for measuring the density of it and (%) recovery was obtained

RESULT AND DISCUSSION

A. Effect of NaOH concentration

Figure 1 showed that increasing concentration of NaOH decrease (%)recovery of bitumen from asbuton

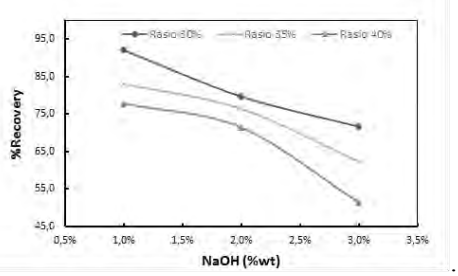

Figure 1. Effect of NaOH concentration at 0.5%wt SLS and diesel oil:asbuton 60:40 condition.

B. Optimum NaOH concentration

Figure 2 showed that optimum point at 1%wt NaOH and 92 (%)recovery was obtained

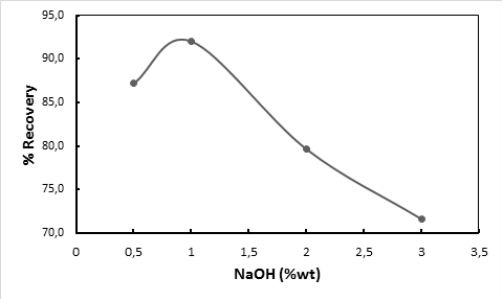

Figure 2. Effect of NaOH concentration at 0.5%wt SLS and diesel oil:asbuton 60:40 condition.

CONCLUSION

Percent (%)recovery decreases with the increasing of NaOH concentration. The highest % recovery obtained in this study is 92% when the concentration of NaOH is 1%wt.

REFERENCES

[1] Akinyemi, LP, dkk. 2013. Physical and Chemical Characterization of Oil Sands Observed at Imeri in Ogun State of South Western, Nigeria. Geoscience Engineering Partnership Journal

[2] Departemen Pekerjaan Umum: Direktorat Jenderal Bina Marga. 2006. Pemanfaatan Asbuton. Pedoman Konstruksi dan bangunan No.001–01/BM/2006.

[3] Dai, Qi dan Ken H. Chung. 1996. Hot Water Extraction Process Mechanism Using Model Oil Sands. Fuel Processing Technology Elsevier Journal Vol. 75 No. 2, 220-226

[4] Miller, J.D dan M. Misra. 1982. Hot Water Process Development For Utah Tar Sands. Fuel Processing Technology Elsevier Journal, Vol 6, 27--59.

Performance Test of Double Crossed Membrane Contactor for Simultaneous Absorption-Desorption Of CO_2 Using Diethanolamine

Yeni Rahmawati[1], Toto Iswanto[1], Muhammad Rifa'i[1]

***Abstract* – 4-Allyl-2-methoxyphenol derivatives was synthesized through the application of methods of Yamaguchi in one pot with a resulting yield of 80-90%. 4-Allyl-2-methoxyphenol derivatives showed good activity in inhibiting the growth of human breast cancer cell MCF-7.**

***Index Terms* – 4-allyl-2-methoxyphenol derivative, cytotoxicity, preparation.**

INTRODUCTION

Breast cancer is the second leading cause of death in women are caused by cancer. Development of compounds anti-cancer is still being done to get an anticancer drug with high activity and low side effects. Anti-cancer compounds can be derived from the results of the synthesis and isolation of medicinal plants. [1, 2].

Clove (Syzygium aromaticum (L.) Merr. & Perry) is one of the original Indonesian spice used as seasoning with its main compound is 4-allyl-2-methoxyphenol which are known to have activity in inhibits the growth of cancer cells such as human breast cancer cells (MDA-MB-231; MCF-7 and T47-D). 4-allyl-2-methoxyphenyl acetate reported to have activity in inhibiting the growth of cancer cells DU-145 (prostate cancer cells androgen-sensitive) and KB (oral squamous cell carcinoma) [1-5].

Synthesis of 4-allyl-2-methoxyphenyl ester is generally conducted through the reaction between 4-allyl-2-methoxyphenol with various acid chlorides and pyridine [4, 6-8]. Yamaguchi method can be used as an alternative method for the synthesis of 4-allyl-2-methoxyphenyl ester. This method is reported to have successfully applied to the synthesis of enzyme inhibitors Lux-S acid, thiol esters, and a large ring lactone [9-11].

In this paper reported the application of the method of Yamaguchi in the synthesis of 4-allyl-2-methoxyphenol derivatives (Figure 1) and cytotoxicity studies on breast cancer cells MCF-7 in obtaining new anticancer compound that has high activity and low side effects.

MATERIAL AND METHOD

A. *General procedure for the synthesis of 4-allyl-2-methoxyphenol derivatives*

A solution of 2,4,6-tricholobenzoil chloride (0.75 mmol), carboxylic acid (0.75 mmol), triethylamine (0.75 mmol) in dichloromethane was stirred at room temperature for 1 h. 4-Dimethylaminopyridine (0.75 mmol) and 4-allyl-2-methoxyphenol (0.50 mmol) was added to the solution, and the mixture was stirred further at room temperature for 6 h. The product was extracted several times with dichloromethane. The combined extract was wished subsequently with 5% aqueous hydrochloric acid, 5% sodium hydroxide, 10% aqueous sodium bicarbonate, and water, dried over magnesium sulphate and the solvent was removed under reduced pressure to yield the titled compound.

1) 4-allyl-2-methoxyphenyl propionate ***(a)***. *White solid. Yield: 88% (0.097 g).* δ_H *(500 MHz,* CD_3OD*): 1.21 (t, J = 7.8 Hz, 3H,* $CH_2C\underline{H}_3$*), 2.57 (q, J = 7.8 Hz, 2H,* $C\underline{H}_2CH_3$*), 3.36 (d, J = 6.5 Hz, 2H,* $C\underline{H}_2CH=CH_2$*), 3.76 (s, 3H,* OCH_3*), 5.09-5.14 (m, 2H,* $CH_2CH=C\underline{H}_2$*), 5.92-6.01 (m, 1H,* $CH_2C\underline{H}=CH_2$*), 6.75 (d, J = 7.8 Hz, 1H, ArH), 6.87 (s, 1H, ArH), 6.91 (d, J = 7.8 Hz, ArH).* δ_C *(125 MHz,* CD_3OD*): 9.55 (*$CH_2\underline{C}H_3$*), 28.11 (*$\underline{C}H_2CH_3$*), 41.05 (*$\underline{C}H_2CH=CH_2$*), 56.33 (*OCH_3*), 113.92 (ArCH), 116.33 (*$CH_2CH=\underline{C}H_2$*), 121.66 (ArCH), 123.53 (ArCH), 138.73 (*$CH_2\underline{C}H=CH_2$*), 139.52 (ArC), 140.52 (ArC), 152.46 (ArC), 174.48 (C=O). MS (EI): m/z 220 (M, 8%), 189 (2), 164 (100), 147 (27), 133 (15), 131 (16), 108 (10), 92 (12), 74 (8), 57 (9). HR-ESI-MS* $[M+H]^+$ *m/z 221.2643, calculated for* $C_{13}H_{17}O_3$*, 221.2723.*

2) b) 4-allyl-2-methoxyphenyl butanoate ***(b)***.*Colourless oil. Yield: 86% (0.1008 g).* δ_H *(500 MHz,* CD_3OD*): 1.07 (t, J = 7.5 Hz, 3H,* $CH_2C\underline{H}_3$*), 1.81 (m, 2H,* $C\underline{H}_2CH_3$*), 2.57 (t, J = 7.5 Hz, 2H,* $C\underline{H}_2CH_2CH_3$*), 3.39 (d, J = 6.5 Hz, 2H,* $C\underline{H}_2CH=CH_2$*), 3.81 (s, 3H,* OCH_3*), 5.09-5.14 (m, 2H,* $CH_2CH=C\underline{H}_2$*), 5.93-6.01 (m, 1H,* $CH_2C\underline{H}=CH_2$*), 6.78 (d, J = 8.4 Hz, 1H, ArH), 6.80 (s, 1H, ArH), 6.95 (d, J = 8.4 Hz, ArH).* δ_C *(125 MHz,* CD_3OD*): 13.65 (*$CH_2\underline{C}H_3$*), 18.65 (*$\underline{C}H_2CH_3$*), 35.95 (*$\underline{C}H_2CH_2CH_3$*), 40.15 (*$\underline{C}H_2CH=CH_2$*), 55.81 (*OCH_3*), 112.76 (ArCH), 116.17 (*$CH_2CH=\underline{C}H_2$*), 120.70 (ArCH), 122.59 (ArCH), 137.17 (*$CH_2\underline{C}H=CH_2$*), 138.12 (ArC), 138.90 (ArC), 150.97 (ArC), 171.93 (C=O). MS (EI): m/z 234 (M, 8%), 164 (100), 147 (27), 131 (16), 108 (10), 91 (12), 71 (8), 51 (9). HR-ESI-MS* $[M+H]^+$ *m/z 235.2335, calculated for* $C_{13}H_{17}O_3$*, 235.2989.*

3) c) 4-allyl-2-methoxyphenyl isobutanoate ***(c)***. *Colourless oil. Yield: 86% (0.1018 g).* δ_H *(500 MHz,* CD_3OD*): 1.34 (d, J = 7.2 Hz, 6H,* $CH(C\underline{H}_3)_2$*), 2.84 (m, 1H,* $C\underline{H}(CH_3)_2$*), 3.39 (d, J = 6.5 Hz, 2H,* $C\underline{H}_2CH=CH_2$*), 3.80 (s, 3H,* OCH_3*),*

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5.09-5.14 (m, 2H, $CH_2CH=C\underline{H_2}$), 5.93-6.02 (m, 1H, $CH_2C\underline{H}=CH_2$), 6.77 (d, J = 7.8 Hz, 1H, ArH), 6.79 (s, 1H, ArH), 6.94 (d, J = 7.8 Hz, ArH). δ_C (125 MHz, CD_3OD): 19.15 ($CH(\underline{C}H_3)_2$), 34.04 ($\underline{C}H(CH_3)_2$), 40.17 ($\underline{C}H_2CH=CH_2$), 55.89 (OCH_3), 112.81 (ArCH), 116.15 ($CH_2CH=\underline{C}H_2$), 120.73 (ArCH), 122.54 (ArCH), 137.22 ($CH_2\underline{C}H=CH_2$), 138.30 (ArC), 138.82 (ArC), 151.04 (ArC), 175.46 (C=O). MS (EI): m/z 234 (M, 8%), 164 (100), 147 (27), 131 (16), 108 (10), 91 (12), 71 (8), 51 (9). HR-ESI-MS $[M+H]^+$ m/z 235.2387, calculated for $C_{13}H_{17}O_3$, 235.2989.

B. Cytotoxicity assay

Breast cancer cells MCF-7 were harvested and seeded at a density 50000 cells/well in 96 well plate. The cells were incubated at 37°C in a fully humidified atmosphere of 5% CO_2 for 24 h. 4-Allyl-2-methoxyphenol derivatives, at six concentration, was added to the cells and incubated further for 24 h. each concentration was tested in triplicate. 100 µL of MTT (0.5 mg/mL) was added per well after incubation. The plates were incubated for an additional 4 h to yield formazan. 5% of SDS in 0.1 N HCl was added, and the plate was covered by aluminium foil, incubated overnight at room temperature in dark room, and read at 570 nm by an ELISA reader. The cytotoxic effect was determined by calculating the absorbance of test resultd as a % of the control wells [12].

RESULT

A. Synthesis of 4-allyl-2-methoxyphenol derivatives

Synthesis of 4-allyl-2-methoxyphenol derivatives the Yamaguchi method was done in two stages. The first stage involved the reaction of carboxylic acid with triethylamine in dichloromethane at room temperature to produce triethylammonium propionate was reacted with 2,4,6-tricholobenzoil chloride produces mixed anhydride. The second stage of the reaction 4-allyl-2-methoxyphenol as nucleophiles with mixed anhydride and 4-dimethylaminopyridine to produce 4-allyl-2-methoxyphenyl propionate, 4-allyl-2-methoxyphenyl butanoate and 4-allyl-2-methoxyphenyl isobutanoate with good yield results is 80-90%.

B. Cytotoxicity assay

Cytotoxicity assay performed with MTT assay, to see the activity of 4-Allyl-2-methoxyphenol derivatives against human breast cancer cells MCF-7 in vitro. Breast cancer cells were given treatment varying concentrations of 4-Allyl-2-methoxyphenol derivatives (6.25, 12.5, 25, 50, 100, 200 µg/mL). From the results obtained that the 4-Allyl-2-methoxyphenyl propionate, 4-Allyl-2-methoxyphenyl butanoate and 4-Allyl-2-methoxyphenyl isobutanoate able to inhibit the growth of human breast cancer cells MCF-7. The IC_{50} were 0.400 µg/mL, 5.73 µg/mL and 1.29 µg/mL for MCF-7, respectively. This indicates that 4-allyl-2-methoxyphenol derivatives has cytotoxicity against human breast cancer cells MCF-7. 4-allyl-2-methoxyphenol derivatives has the best activity better than 4-allyl-2-methoxyphenol (IC50 1.5 µM) [1].

CONCLUSION

4-allyl-2-methoxyphenol derivatives was synthesized through the application of methods of Yamaguchi in one pot with a resulting yield of 80-90%. 4-allyl-2-methoxyphenol derivatives showed good activity in inhibiting the growth of human breast cancer cell MCF-7. The IC_{50} were 0.400 µg/mL, 5.73 µg/mL and 1.29 µg/mL for MCF-7, respectively. The results showed that 4-allyl-2-methoxyphenol derivatives has the potential to be developed as an anti-breast cancer.

ACKNOWLEDGEMENTS

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REFERENCES

[1] Al-Sharif et al. “Eugenol triggers apoptosis in breast cancer cells through E2F1/survivin down-regulation”, *BMC Cancer*, vol 13: 600, pp.1-10, 2013.

[2] A. Carrasco et al. "Eugenol and its synthetic analogues inhibit cell growth of human cancer cells (Part I)", *Journal of Brazil chemical Society*, vol. 19 (3), pp. 543–548, 2008.

[3] H. Barakat. "Composition, Antioxidant, Antibacterial Activities and Mode of Action of Clove (Syzygium aromaticum L.) Buds Essential Oil", *British Journal of Applied Science Technology*, vol 4 (13), pp. 1934–1951, 2014.

[4] D. Bhowmik et al. "Recent trends in Indian traditional herbs Syzygium aromaticum and its health benefits", *Journal of Pharmacognosy and Phytochemistry*, vol 1, pp. 6–17, 2012.

[5] N.Vidhya and S. N. Devaraj., "induction of apoptosis by eugenol in human breast cancer cells". *Indian Journal of Experimental Biology*, vol. 49, pp. 871-878, 2011.

[6] A. E. Díaz-Álvarez et al. "A general route for the stereoselective synthesis of (E)-(1-propenyl) phenyl esters by catalytic C=C bond isomerization", *Tetrahedron*, vol. 68, pp. 2611-2620, 2012.

[7] M. A. Farias et al. "Eugenol derivatives as potential anti-oxidants: is phenolic hydroxyl necessary to obtain an effect?" *Journal of Pharmacy and Pharmacology*, vol. 66, pp. 733-746, 2014.

[8] H. Sadeghian et al. "Design and synthesis of eugenol derivatives, as potent 15-lipoxygenase inhibitors", *Bioorganic & Medicinal Chemistry*, vol. 16, pp.890-901, 2008.

[9] I. Dhimitruka and J. SantaLucia Jr., "Investigation of the Yamaguchi esterification mechanism. Synthesis of a Lux-S enzyme inhibitor using an improved esterification method", *Organic Letters*, vol. 8 (1), pp.47-50, 2006.

[10] J. Inanaga et al. "A rapid esterification by means of mixed anhydride and its application to large-ring lactonization", *Bulletin of The Chemical Society of Japan*, vol. 52, pp.1989-1993, 1979.

[11] Y. Kawanami et al. "Synthesis of thiol esters by carboxylic trichlorobenzoic anhydrides", *Bulletin of The Chemical Society of Japan*, vol. 54, pp. 943-944, 1981.

[12] K. Mustikasari and M. Santoso., "3,3'0Di(5,7-dibromoindol-3-il)-indolin-2-ona: Sintesis and Uji Sitotoksis terhadap Sel Kanker Kolon WiDr", *Jurnal Ilmu Kefarmasian Indonesia*, vol. 11, pp. 156-159, 2013.

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Microbend in an SMS Fiber Structure

Fitri Rahmah[1], Sekartedjo[1], Agus Muhamad Hatta[1]

Abstract – We present a numerical and experimental model of microbend in an SMS fiber structure. We obtain the numerical model by using several boundary conditions in SMS fiber structure. These conditions divided into transmission of light in a straight multimode fiber and in a bend multimode fiber. The microbend in multimode fiber affects the radius of curvature of the fiber. Thus, causes radiation several modes and then re-distribution of guided modes. The guided modes itself will vary in MMI and bring out different output power. The numerical result compare well with the experimental result from variation of the radius of curvature of the fiber (R) and the arc length.

Index Terms – microbend, SMS, MMI.

INTRODUCTION

The demonstration of singlemode-multimode-singlemode (SMS) fiber optic as sensor has been developed for many years. For sensing element, self-imaging formation and multimode interference (MMI) are the key parameters in the SMS fiber sensor [1]-[3]. Self-imaging is a waveguide phenomenon in which the input light profile is reproduced in a periodic interval along the propagation of light [4]. The field input of singlemode lead-in in SMS fiber structure will be the same with the output of singlemode lead-out if the length of multimode fiber is the same as the re-imaging length. When perturbation such a microbend is applied in the SMS fiber structure, it causes re-distribution of light along the fiber, then changes its intensity or loss. Loss caused by microbend is due to the coupling of the highest guided mode to the radiated modes [5]. The total of guided mode caused by microbend depends on the radius of curvature of the fiber. The formula for the effective number of guided modes is presented by a curved fiber formula [6]. A model about microbend in SMS fiber structure has not developed yet, but a formulation of transmission of light in straight SMS fiber structure has been presented by Kumar [7]. In this paper, we formulate the microbend SMS by using the light transmission formula in straight SMS fiber structure [7] and taking into account the effective number of guided modes due to the microbending as in [6].

METHOD

In our model as in Figure 1, there are several boundary conditions when the microbend is applied to the SMS fiber structure. By using a modal propagation analysis [7], the field profile (ψ) at the boundary can be written as in the equation (1)

$$\Psi_k = \Psi_{k+1} = \sum A_m \Psi_{km} e^{-i\beta mLk} \qquad k = 1,2 \qquad (1)$$

Where A_m is the amplitude of the mth mode of the multimode fiber, βm is the propagation constants of the mth symmetric mode, and L is the length of the multimode fiber section.

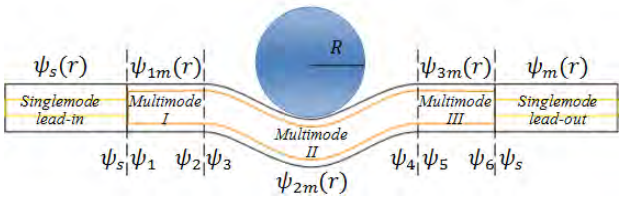

Figure 1. The boundary conditions along SMS fiber structure due to microbend

At the first splice between singlemode lead-in and multimode section I, the power will couple to various modes in the multimode fiber. In order to obtain the amplitude of the mode (A_m), we can calculate the overlap integral between field profile in boundary condition respectively as in

$$A_m = \frac{\int_0^\infty \psi_s \psi_m r dr}{\int_0^\infty |\psi_m|^2 r dr} \qquad (2)$$

In the section II, the presence of microbend with a radius R affect the fiber radius of curvature and the total number of guided modes [6] as in

$$\mathrm{m_b} = \mathrm{m}\left\{1 - \frac{\alpha+2}{2\alpha\Delta}\left[\frac{2a}{R} + \left(\frac{3}{2n_1 kR}\right)^{2/3}\right]\right\} \qquad (3)$$

Where m_b is the total of guided mode caused by microbend, α is the refractive index profile, Δ is the refractive index difference, and R is the radius of curvature of the fiber. The changes of the total number of guided modes will affect the propagation constants (β_{mb}) as in the equation (4). These values are used to compute a new field profile as in the equation (1).

$$\beta_{mb} = kn_1\left[1 - \frac{2(2m_b+1)\alpha_{m_b}}{k^2 n_1^2}\right]^{1/2}; m_b = 0,1,2,\ldots \quad (4)$$

At the last splice, the power between multimode section III and singlemode lead-out fiber will couple from various modes of the multimode fiber to the lead-out singlemode fiber. The output power can be calculated by using equation (5).

$$P_{(dBm)} = 10\log_{10}\frac{\left|\int_0^\infty \psi_s \psi_6(z=L3) r dr\right|^2}{\int_0^\infty |\psi_6|^2 r dr \int_0^\infty |\psi_s|^2 r dr} \qquad (5)$$

RESULT

In Figure 2, it is shown the numerical result of our model. One can see in Figure 2, the output power varies with the radius of curvature (R) and the arc length in the unit of circumference ($2\pi R$). Microbend leads to change the number of R and the arc length. Thus, causes radiation several modes and then re-distribution of guided modes. The guided modes itself will vary in MMI and bring out different output power. It is also presented the experimental result of the transmission of SMS fiber structure due to microbend. The experimental result show a different

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output power as a function of radius of curvature of the fiber (R) and the arc length.

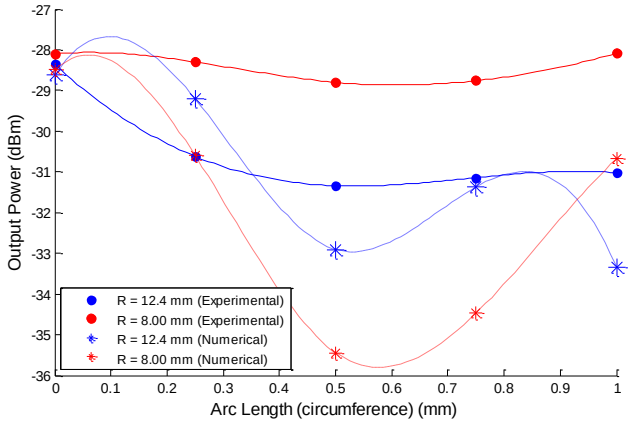

Figure 2. Variation of normalized output power as a function of radius of curvature (R) and arc length in SMS fiber structure

The linkage between numerical and experimental results can be tested by using the principle of correlation and covariance. Correlation is a relationship between data, which is can be measured by a value called the correlation coefficient. Covariance show the association between the two variables. The numerical and experimental results for radius of microbender 12.4 mm show a strong correlation at 0.9916 and also give a positive covariance value. It also happen in radius of microbender 8.00 mm, where the results of numerical and experimental testing show a strong correlation value at 0.9830 and the value of covariance is positive. The positive covariance value indicates that the variables vary in the same direction. The numerical and experimental results show a satisfactory agreement. Future work will consider the use of this structure for sensing element.

CONCLUSION

We have developed a numerical model for microbend in SMS fiber structure. The model resolved using the boundary condition of the transmission in the straight SMS fiber and the transmission in the bend SMS fiber. The transmission in the bend SMS fiber causes radiation several modes and makes different output power. A comparison to the numerical model are done experimentally and show a good agreement.

REFERENCES

[1] Mehta, et al.," Multimode interference-based fiber optic displacement sensor," *IEEE Journal & Magazines of Photonics Technology Letters*, vol. 15, pp. 1129 – 1131, 2003.

[2] Q. Wang and G. Farrell, "All-fibre multimode-interference-based refractometer sensor: proposal and design,"*Optics Letters*, vol. 31, pp. 317 – 319, 2006.

[3] E. Li, X.Wang, and C. Zhang, "Fiber-optic temperature sensor based on interference of selective higher-order modes,"*Applied Physics Letters,* vol. 89, 091119, 2006.

[4] L. B. Soldano and E. C. M. Pennings, "Optical multi-mode interference devices based on self-imaging: principles and applications," *IEEE Journal of Lightwave Technology*, vol. 13, pp. 615 – 627, 1995.

[5] Nicholas Lagakos, et al., "Microbend Fiber Optic Sensor," *Applied Optics*, vol. 26, pp. 2171 – 2180, 1987.

[6] D. Gloge, "Bendding loss in multimode fibers with graded and ungraded core index," *Applied Optics*, vol. 11, pp. 2506 – 2513, 1972.

[7] Arun Kumar et al.," Transmission characteristics of SMS fiber optic," *Optics Communications,* vol. 219, pp. 215 – 219, 2003.

Aromatic Hydrocarbons of Wondama Coal, Papua Barat

Christoffel S. I. Maweikere[1], R. Y. Perry Burhan[1]

Abstract – Wondama coal were subjected to solvent extraction and aromatic hydrocarbon fractions obtained by thin layer chromatography with n-hexane as eluent. Aromatic fractions identified by Gas Chromatography-Mass Spectroscopy (GC-MS). Aromatic seskuiterpenoids, diterpenoid and triterpenoids were found in Wondama coal. This composition illustrates sources of organic matter derived from terrestrial higher plants.

Index Terms – Aromatic hydrocarbons, Wondama coal.

INTRODUCTION

Terpenoids from higher plants occur in various geological samples such as coal, petroleum and sediments [1]. In particular, aromatic terpenoids are commonly found in mature sediments [2].

Biological terpenoids are presumably transformed to aromatic terpenes during early diagenesis via microbially mediated reactions. Aromatic terpenoids which are generally used as a biological marker are diterpenoid and triterpenoids. Aromatic diterpenoid can be used as a marker chemotaxonomic of gymnosperms, while triterpenoids derived from angiosperms [1].

METHOD

To obtain hydrocarbons, sample extracted by soxhlet method. For soxhlet extraction, 50 g of bulk coal was extracted with 250 mL dichlorometane-methanol (93:7 by volume) mixture for 72 h. After extraction, the solvent was evaporated at room temperature under vacuum [5].

The aromatic hydrocarbons were obtained by fractionation on preparative thin layer chromatography eluting with *n*-hexane and then identified by GC-MS [4]

RESULT AND DISCUSSION

Aromatic terpenoids were identified as seskuiterpenoids, diterpenoids and triterpenoids. Seskuiterpenoids we found as naphthalene skeleton such as calamenene (*m/z* 159, M^+ 202; I), cadalene (*m/z* 183, M^+ 198; II), 1,2,3,4-tetrahydro-1,1,6-trimethylnaphthalene (*m/z* 159, M^+ 174; III), 1,2,3,4-tetrahydro-6-(1,1-dimethyl)-naphthalene (*m/z* 173, M^+ 188; IV) [3],[6]. (Fig. 1). Their compound have been considered indicators of terrestrial organic matter, derived from different plant types [7]. Cadalene occurs in a wide variety of vascular plants, it derives from cadinane and cadinol. It occurs in plant resins and some conifers [7].

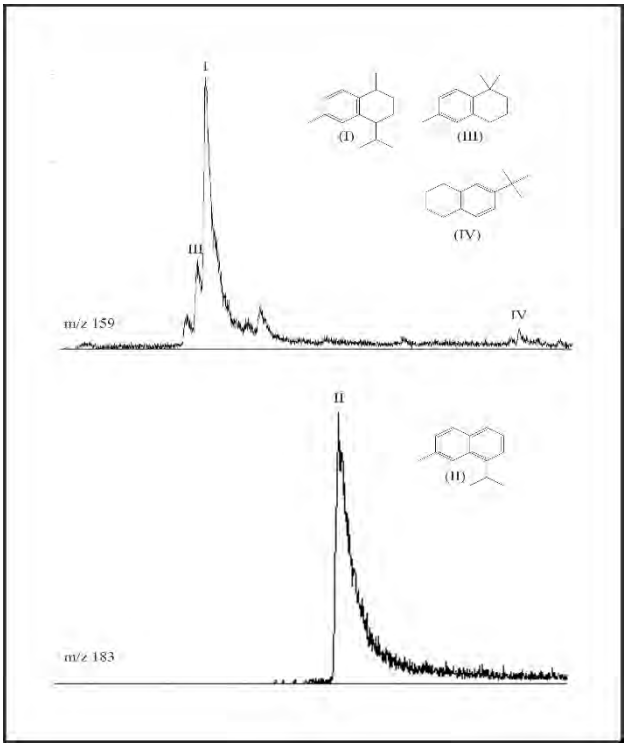

Figure 1. Aromatic seskuiterpenoids of wondama coal.

Aromatic diterpenoids were identified as 3,8-dimethyl-hexahydrophenantrene (*m/z* 197, M^+ 212; V) and 3,4-dihydroretene (*m/z* 221, M^+ 236; VI) (Fig. 2). These compounds are derived from precursor abietic acid, which is a major constituent of gymnosperms, especially conifer resins [1],[6].

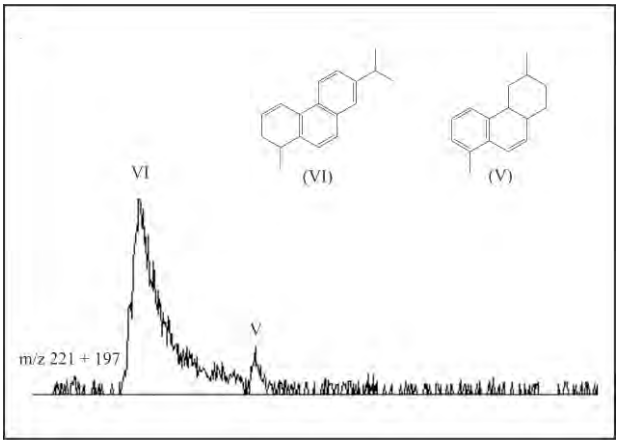

Figure 2. Aromatic diterpenoids of wondama coal.

Aromatic tritrpenoids were detected as a diaromatic. The mass fragments of *m/z* 292 show a series of A ring degraded-diaromatic (VII-IX) (oleanane, ursane and lupane skeleton) [1]. Fig 3 show diaromatic triterpenoids of Wondama Coal.

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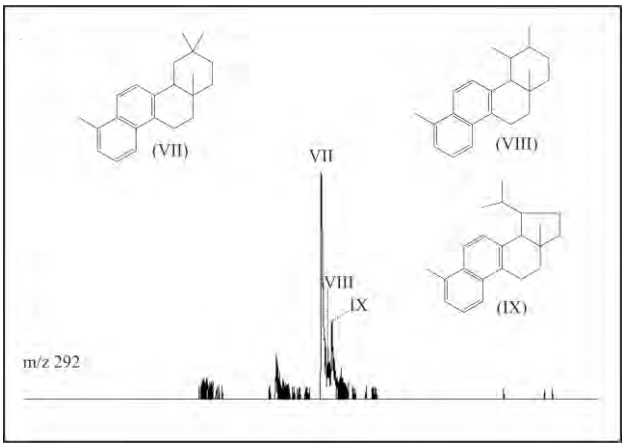

Figure 3. Aromatic triterpenoids of wondama coal.

These aromatic triterpenoids are intermediates in a series of postulated pathways for progressive aromatization of angiosperms triterpenoids, probably derived from β- and α-amyrins [1],[6].

The presence of des-A-triterpenoids shows that there are activities of microorganisms in the environment of Wondama coal formation [7].

CONCLUSION

Organic matter of Wondama coal contributed from conifer resins gymnosperms such as 3,4-dihydroretene and considered from vascular plants angiosperms such as aromatic triterpenoids. Source of Wondama coal organic matter commonly from higher plants. Aromatic hydrocarbons in this study showed that the coalification of Wondama coal has entered diagenesis stage and influenced by the activity of microorganism.

ACKNOWLEDGEMENTS

The first author is thankful to Direktorat Jenderal Pendidikan Tinggi (DIKTI) for their post-graduate scholarship. We thank to Forensic Laboratory POLDA Jawa Timur for help in the GC-MS measurements.

REFERENCES

[1] Nakamura, H., Sawada, K. dan Takahashi, M. (2010), "Aliphatic and Aromatic Terpenoid Biomarkers in Cretaceous and Paleogene Angiosperm Fossils from Japan", *Organic Geochemistry*, Vol. 41, hal. 975–980.

[2] van Aarssen., B.K., Alexander, R., Kagi, R, (2000), "Higher Plant Biomarkers Reflect Palaeovegetation Changes During Jurassic Times", *Geochimica et Cosmochimica Acta*, Vol. 64, No. 8, hal. 1417–1424.

[3] Romero-Sarmiento, M.F., Riboulleau, A., Vecoli, M., Lagoun-Défarge, F. dan Versteegh, G.J.M. (2011), "Aliphatic and aromatic biomarkers from Carboniferous coal deposits at Dunbar (East Lothian, Scotland): Palaeobotanical and palaeoenvironmental significance", *Palaeogeography, Palaeoclimatology, Palaeoecology*, Vol. 309, hal. 309-326.

[4] Fabiańska, M.J. dan Kurkiewicz, S. (2013), "Biomarkers, Aromatic Hydrocarbons and Polar Compounds in the Neogene Lignites and Gangue Sediments of the Konin and Turoszów Brown Coal Basins (Poland)", *International Journal of Coal Geology*, Vol. 107, hal. 24-44.

[5] Farhaduzzaman., Abdullah, W.H., Islam., A. (2012), "Depositional Environment and Hydrocarbon Source Potential of the Permian Gondwana Coals from the Barapukuria Basin, Northwest Bangladesh", *International Journal of Coal Geology*, Vol. 90-91, hal. 162-179.

[6] Wang, T.G., dan B. R. T. Simoneitt, B.R.T, (1991), "Organic Geochemistry and Coal Petrology of Tertiary Brown Coal in the Zhoujing Mine, Baise Basin, South China", *Fuel*, Vol. 70.

[7] Romero-Sarmiento, M.F., Riboulleau, A., Vecoli, M. dan Versteegh, G.J.M. (2011), "Aliphatic and Aromatic Biomarkers from Gondwanan Sediments of Late Ordovician to Early Devonian Age: An Early Terrestrialization Approach", Organic Geochemistry, Vol. 42, hal. 605-617.

Effect of Glutaraldehyde Concentration Variation toward Properties and Performance of Composite Membrane (Chi-Mmt) for DMFC Application

Sudir Umar[1], Dian Permana[1], Lukman Atmaja[1]

Abstract – Membrane CS/MMT-GA were synthesized by inversion phase method. In this study, CS as matrix, MMT as filler and GA as cross linking agent. CS-GA-MMT showed high performance as good candidate for DMFC. The best composition was obtained to CS/MMT-GA2 with highest proton conductivity and lower methanol permeability.

Index Terms –Chitosan, DMFC, Glutaraldehyde, MMT.

INTRODUCTION

Polyelectrolyte membranes (PEMs), as the key part of DMFC systems, have crucial role as the transport medium for generated protons from oxidation of fuel in fuel cell [1-2]. Nafion is currently the most commonly utilized Proton Exchange Membrane (PEM) for DMFCs because of superior chemical stability and high proton conductivity. However, it still has some drawbacks such as reduction in conductivity at high temperature, high methanol permeability and high production cost [3]. Therefore, the development of new alternative hybrid membranes that will provided improved character, environmental benign, and low production cost for fuel cell application is highly required. The new DMFCs membranes require several important properties, including good film formation, high methanol rejection, good mechanical stability and hydrophilic character to allow sufficient ionic conductivity [4-5].

Chitosan (CS), a polysaccharide bio resource, has been attracting considerable interest to substitute Nafion as DMFCs in fuel cell application [6]. It was pointed out that cationic polyelectrolyte such as chitosan has unique character due to the presence of both amine and hydroxyl groups [7]. Although it has low ionic conductivity compared to Nafion, but it has low methanol permeability. Therefore, it makes chitosan membrane an excellent material to be further developed [8].

In this study, DMFCs membranes were prepared from mixture of chitosan (CS) as matrix and montmorillonite (MMT) as filler. Meanwhile, glutaraldehyde with various concentration as cross linking agent has been chosen for enhance proton conductivity of hybrid membrane. The formation of polyelectrolyte hybrid composite membrane from both CS/MMT and CS/GA are expected to improve their conductivity, rejecting methanol, mechanical properties and thermal stability. The aim of this research is to study the effect of glutaraldehyde in various concentration toward composite membrane, for DMFC by analysis the thermal stability, mechanical properties, proton conductivity and methanol permeability.

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EXPERIMENTAL

A. *Synthesis of CS/GA-MMT membranes*

2.0 g CS powders were dissolved in 75 mL of acetic acid solution at 80 ^{O}C. Subsequently, 80 mL of glutaraldehyde with various concentration of 0.10; 0.15; 0.20 and 0.25 were added into chitosan solution [9]. A certain amount of montmorillonite was dispersed in the portion of @% of acetic acid solution by ultrasonic treatment for 30 min. Subsequently, two portions of solution were mixed, and stirred at 80 ^{O}C for 30 min. Then, ultrasonic treatment and stirring were carried out alternatively, each for 30 min. After thorough degasification, the mixture was cast onto clean glass plate and dried at room temperature for 72 h. Next, 1 N sodium hydroxide solution was added to the dry membranes in the Petri dishes several times. The neutralized membranes were washed several times with deionized water. Finally, the membranes were dried at 25 ^{O}C. The thickness of all membranes was in the range of 2.0 to 4.0 (10^{-2}) cm. the membranes were denoted as CS as pure chitosan, CS-MMT as chitosan/montmorillonite, CS/GA1-MMT, CS/GA2-MMT, CS/GA3-MMT and CS/GA4-MMT as chitosan/glutaraldehyde-montmorillonite.

B. *Characterizations*

Fourier transform infrared spectra (4,000-500 cm^{-1}, resolution 4 cm^{-1}) of modified-montmorillonite samples and membranes were recorded with a Shimadzu FTIR spectrometer. Thermal Gravimetry Analysis (TGA) and Scanning Electron Microscopy (SEM), as well asa proton conductivity and methanol permeability were used to characterised the membrane.

RESULT AND DISCUSSION

A. *Synthesis of CS/GA-MMT membranes*

Generally, the CS/GA-MMT membranes in various concentration of glutaraldehyde were successfully synthesized by inversion phase method. Fig. 1 shows the FTIR spectra of CS, CS-MMT and CS/GS-MMT.

The characteristic bands at 3420 cm^{-1}, 1650 cm^{-1}, and 1550 cm^{-1} are attributed to hydroxyl group, amide I and amide II groups of chitosan, repectively. The peaks at 1650 cm^{-1} and 1550 cm^{-1} shifted to higher wavenumber at 1655 cm^{-1} (C=N) and 1560 cm^{-1} (C=C), providing support that cross-linking between amine groups of chitosan and the aldehyde groups of GA has occurred [10].

B. Mechanical and thermal property

Good mechanical and thermal properties are required for PEMs in DMFCs to guarantee a long lifetime of fuel cells. Tensile strength results of all membranes were listed in Table 1. According to TGA results the increasing glutaraldehyde concentration will significantly increased the thermal stability of the CS/GA-MMT membranes.

Table 1. Tensile strength of CS, CS-MMT and CS/GA-MMT

Membranes	Tensile Strength (MPa)
CS	22.0
CS-MMT	14.0
CS/GA1-MMT	20.5
CS/GA2-MMT	27.6
CS/GA3-MMT	38.0
CS/GA4-MMT	11.8

C. Proton conductivity and methanol permeability

Proton conductivity of CS, CS -MMT, and CS/GA-MMT membranes was determined by means of the complex impedance method. All impedances were carried out after hydration of the membranes. The results clearly seen that adding glutaraldehyde into chitosan increased the proton conductivity in wide range temperature. The best composition was obtained for CS/GA2-MMT with highest proton conductivity of 26.24×10^{-4} $S.cm^{-1}$ at 60 °C.

The methanol permeability decreased as increasing concentration of glutaraldehyde which added to modified chitosan. It is indicated that glutaraldehyde was taken place in membrane to improve the methanol rejecting. The lower methanol permeability was obtained in CS/GA1-MMT of 6.28×10^{-7} $cm^2.s^{-1}$.

CONCLUSION

The increase of glutaraldehyde concentration from 0.10 to 0.25 caused the increase of mechanical and thermal properties, proton conductivity and enhance methanol rejecting. The best composition of membrane was obtained in CS/GA2-MMT which possesed the highest proton conductivity and lower methanol permeability. However, the proton conductivity was still an order magnitude lower than Nafion at 3.84×10^{-1} $S.cm^{-1}$. This result implies that this novel complex-composite membrane is a good candidate for DMFC in fuel cell application.

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REFERENCES

[1] A. H. Haghighi, M. M. Hasani-Sadrabadi, E. Dasthimoghadam, G. Bahlakeh, S. E. Shakeri, F. S. Hojati Emami, and H. Moaddel, "Direct methanol fuel cell performance ofsulfonated poly(2,6-dimethyl-1,4-phenylene oxide)-polybenzimidazole blend proton exchange membranes," Int. J. Hydrogen Energy., vol 36, pp. 3688-3696, Jan. 2011.

[2] K. D. Kreur, "On development of proton conducting polymer membranes for hydrogen and methanol fuel cells" J. Membr. Sci., vol 185, pp. 29-39, Jan. 2001.

[3] B. Smitha, S. Sridhar, and A. A. Khan, "Solid polymer electrolyte membranes for fuel cell application – a review," J. Membr. Sci., vol. 259, pp. 10-26, Aug. 2005.

[4] B. Smitha, S. Sridhar, and A. A. Khan, "Polyelectrolyte complexs of chitosan and poly(acrylic acid) as proton exchange membrane for fuel cells," Macromolecules, vol. 37, pp. 2233-2239, Feb. 2004.

[5] H. Wu, B. Zheng, X. Zheng, J. Wang, W. Yuan, and Z. Jiang, "Surface-modified Y zeolite-filled chitosan membrane for direct methanol fuel cell." J. Power Sources, vol. 173, pp. 842-852, July 2007.

Photochemistry in $CuInS_2$ Quantum Dots/Polyoxometalate System

Azzah Dyah Pramata[1], Tetsuya Kida[2]

Abstract* – Energy transfer involving semiconductor quantum dots (QDs) has received increased attention in recent years because of high photostability and size-tunable optical properties. Here, we study photochemistry in quantum dot/polyoxometalate (POMs) systems and utilize quantum dots as light antenna that captures visible light to sensitize wide band gap POMs. We also demonstrate the photoenergy storage properties of $CuInS_2$ QD/POM systems. The PL quenching and the decrease in PL lifetime are clear indication that the excited electron of $CuInS_2$ was deactivated by electron transfer to POM such as $PMo_{12}O_{40}$, $W_{10}O_{32}$ and $SiW_{10}O_{36}$ that were hybridized with a cationic surfactant and dispersed together in an organic solvent. The quantum yields of $CuInS_2$ QDs were 2.32% with 3.9 nm in particle size. Irradiating QD/POM systems with visible light generates a one-electron reduced form of POMs, suggesting the reduction of POMs. Photoenergy can be stored as reduced POM under deaerated conditions by visible light. Stored electron in POM can be discharged afterwards via reductive reactions such as oxygen under the dark.

***Index Terms* – Quantum dots, polyoxometalate, photoenergy.**

INTRODUCTION

Quantum dots (QDs) as luminescent semiconductors have been eagerly explored because of their flexible solution processing, band gap tunability, high photoluminescent quantum yields, and narrow emission peaks with a broad band gap excitation and high photosensitivity [1]. Because of their promising optical properties, their utilization in photoenergy conversion has been attracting much attention. Some quantum dots show high photocatalytic activities such as water reduction and organic decomposition [1][2]. As nanoscale clusters, polyoxometalates (abbreviated POMs) have also been an active research target for many years. POM is a unique class of inorganic metal-oxide clusters having distinctive physical and chemical properties such as strong bronsted acidity and strong oxidizing capability [3].

They also have stable redox properties and can trap and accommodate photo-excited electrons without changing their crystal structure, but have limited photocatalytic activities only in UV region (wavelength below 400 nm). We expect that coupling quantum dots with POMs could form a new class of optical material families, which exhibit photoactivity even under visible light irradiation due to tunable bandgaps of quantum dots. Here, we study photochemistry in quantum dot/polyoxometalate systems and utilize quantum dots as light antenna that captures visible light to sensitize wide band gap POMs. We also demonstrate the photoenegy storage properties of QD/POM systems.

EXPERIMENTAL METHOD

Synthesis was done by mixing $Cu(acac)_2$ and $In(acac)_3$ in 1-dodecanethiol inside a three-necked flask and heated at 100°C for 30 minutes under vacuum conditions. The temperature then raised to and be hold for 1 hour at certain temperatures (200°C, 215°C and 230°C) under argon gas flow. The products were washed three times by precipitation using hexane with excess ethanol.

POM-surfactant hybrids were prepared by mixing DODA (dioctadecylammonium brimide) and POMs such as $SiW_{12}O_{40}^{4-}$, $W_{10}O_{32}^{4-}$ and $PW_{12}O_{40}^{3-}$ in water. Commercial reagents of $SiW_{12}O_{40}^{4-}$ and $PMo_{12}O_{40}^{3-}$ were used without any further purification. $W_{10}O_{32}^{4-}$ was prepared by polycondentation WO^{4-} from 30 mL of Na_2WO_4 solution with HCl at pH 2. The light yellow precipitates were collected by evaporation.

The colloidal size of quantum dots was determined with a DLS spectrophotometer. The crystal structure was observed by using XRD with CuKα radiation and TEM observation. Steady state PL spectra and the light absorption properties were obtained with a spectrometer. Fluorescence lifetimes measured with a commercial instrument. The photocatalytic measurements were done by dissolving quantum dots together with POM/DODA catalyst in hexane. Optical characterization was performed after removing oxygen. Triethylamine was added as an electron donor to avoid the direct photooxidation of quantum dots in the phase aqueous solution. The solution was exposed with UV light by using a 150 W Xe lamp with 500 nm optical cut-off filter for 1-30 minutes.

RESULT AND DISCUSSION

The XRD patterns of synthesized $CuInS_2$ are similar with the reference of the tetragonal $CuInS_2$ phase. TEM imaging and DLS measurements for $CuInS_2$ show that the nanocrystal size is about 2-3 nm. Band gap of the $CuInS_2$ sample was estimated by plotting $(\alpha h\nu^2)$ and eV from Uv/Vis absorption data[4]. Band gap value is significantly larger than that of bulk $CuInS_2$ (1.5 eV), indicating the quantum size effect of the very small crystals. The PL emission spectra have a maximum peak at 650 nm wavelength when excited with 470 nm. Optimum quantum yield (QY) is 3.32% with 1.98 nm particle size.

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Table 1. $CuInS_2$ QDs properties at different temperature synthesis

T (°C)	d (nm)	Band Gap (eV)	τ (ns)	QY (%)
200	2.23	1.98	123.27	1.140
215	3.71	1.98	144.34	2.320
230	9.38	1.92	62.94	0.714

The PL emission intensity of QDs decreases by adding POM in the system. PL lifetime measurement was also performed to confirm whether photo-excited charges in the semiconductor particles are efficiently transferred to POMs. The decay time traces have two components: a fast (τ_1) and a slow decay (τ_2) [1] [4]. By adding POM, both components show decreasing behaviors. Moreover, the average PL life time of semiconductor quantum dots apparently decreases by mixing with POMs. The PL quenching and the decrease in PL lifetime are clear indication that the excited electron of $CuInS_2$ was deactivated by electron transfer to POM. Indeed, irradiating QD/POM systems with visible light generates an one-electron reduced form of POMs, suggesting the reduction of POMs. We observed the formation of one-electron reduced POMs as the reaction intermediate by monitoring a change in absorbance after visible light irradiation. This reduced state is stable in the absence of electron acceptors such as oxygen [3]. The energy from the light creates hole-electron pairs. They can be stored in POMs due to its excellent redox properties [3] [4]. When oxygen is introduced into the system, the trapped electron will discharge subsequently by oxygen reduction and the system can return back to the original state. The observed phenomena also indicate that $CuInS_2$ QDs act as antenna to capture visible light and inject electrons to POMs. The results suggest the feasibility of photoenergy charge-discharge cycles based on QD/POM systems.

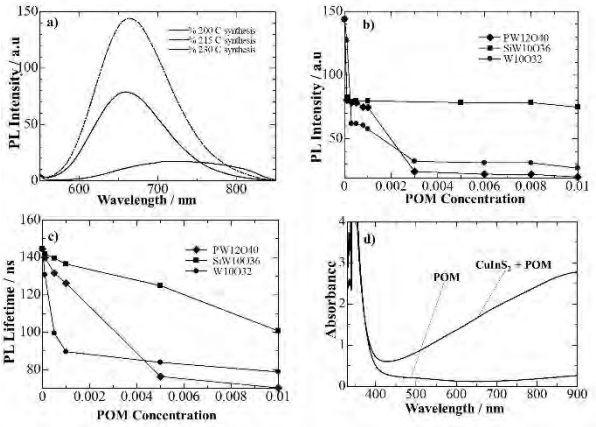

Figure 1. a) PL intensity of $CuInS_2$ QDs, b) PL Intensity quenching by pom, c) pl lifetime quenching by POM and d) absorbance after 30 minutes visible light irradiation.

CONCLUSION

In summary, we have demonstrated visible-light induced electron transfer from CuInS2 quantum dots (QDs) to polyoxometalates (POMs) that are hybridized with the cationic surfactant in an organic solvent under visible light irradiation. Using $CuInS_2$ QDs as antenna that captures visible light, photocatalytic reactions can take place even under visible light irradiation. The result indicates the feasibility of using reduced POMs as a reservoir for electrons that are photogenerated in QDs by visible light excitation. This system potentially stores solar energy and drives reduction reactions under dark.

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REFERENCES

[1] Alivisatos, A.P. Perspectives on the physical chemistry of semiconductor nanocrystals. J. Phys. Chem. 1996, 100, 13226-3239.

[2] J.K.Oleysiak et al. Synthesis and Application of Colloidal $CuInS_2$ Semiconductor Nanocrystals. ACS Appl.Mater.Interfaces.2013, 5, 12221-12237.

[3] L.V.Nadal et al. Towards Polyoxometalate Clusters Based Nano Electronics. Chem.Eur.J.2013, 19, 16502-16511.

[4] L.Zheng et al. $CuInS_2$ Hierarchical Microarchitectures for Photoctalytic H2 Evolution under Visible Light.Inorganic Chemistry.2009, Vol.48, No.9, 4003.

Surface Functionalization of Upconversion Nanoparticle for Biological Usage

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Abstract – Upconversion nanoparticle (UCNP) coated with uniform silica shells, which were further functionalized with poly(ethylene glycol) (PEG) and (3-aminopropyl)triethoxysilane (APTES), produces water dispersible core-shell structured UCNPs with average hydrodynamic size around 100 nm. The hydrothermal treatment to the particle stabilize amines of APTES on the surface of UCNPs. The stable and positive zeta potential also prove that the amines is successfully attached on the particle's surface, with good stability in colloidal solution. We also discovered that hydrothermal treatment temperature over 200 °C diminish the luminescence properties of UCNPs.

Index Terms – Upconversion, functionalization, silica, core-shell.

INTRODUCTION

Luminescence nanomaterials offer great potential for disease diagnose and even treatment. In biomedical field, they have been demonstrated to be useful in in vivo imaging and photodynamic therapy [1]. For the biological application mentioned above, utilization of upconversion luminescence (UCL) emission is favorable [2]. Upconversion luminescence is a process where low energy light is converted to higher energy light through sequential absorption of multiple photons from low power continuous wave near infrared (NIR) laser. Upconversion luminescence generates low auto-fluorescence and less damage to cells, it also has deeper penetration depth compare with ultraviolet (UV) and visible light excitation [3]. Ideal upconversion nanoparticle system not only should own multimodality for imaging and therapy purpose, but also, most importantly, should have stable colloidal stability in physiological buffer.

A sort of method to synthesize UCNPs have been evolved, three common methods usually used. They are co-precipitation [4], thermal decomposition [5], and hydro(solvo)thermal process [6]. Thermal decomposition is the best technique to obtain highly monodisperse UCNPs with highest luminescent quantum yield. In this method, rare earth (RE) trifluoroacetates are heated to attain thermal equilibrium in the presence of oleic acid and octadecene [7]. Here, oleic acid function as a stabilizing agent to terminate particle agglomeration, while octadecene behave as a high boiling point solvent. The oleic acid forms a coordinate bond to the surface of particles, hence the surface is very hydrophobic. UCNP prepared via thermal decomposition is well dispersed in organic solvents such as cyclohexane, but insoluble in aqueous solution.

If employed in biosciences, UCNPs have to be well dispersible in physiological solution. Furthermore, in order to make particles carrying bioeffectors, the surface of UCNPs has to be functionalized to facilitate bioconjugation of appropriate biomolecules. Such surface chemistry is expected to be versatile to immobilize proteins, nucleic acid oligomers, peptide, and drugs [8]. To fulfil these requirements, we hence studied the surface functionalization of upconversion nanoparticles for biological usage using detergent assisted silica coating followed by hydrothermal Stober process to install polyethylene glycol (PEG) and amine.

METHOD

A. Synthesis of $NaYF_4$ nanocrystals

$NaYF_4$ nanocrystal doped with lanthanide ion is synthesized by the previous protocol [5] with minor modification. UCNPs is synthesized by mixing corresponding amount of yttrium and lanthanide acetate hydrate in 60 mL 1-octadecene and 24 mL oleic acid. The solution was heated to 120 °C under vacuum with stirring to remove water and oxygen. The mixture was cooled down to room temperature and add 40 mL of methanol solution containing corresponding amount of ammonium fluoride and sodium hydroxide. The mixture was stirred and the temperature was increased to 80 °C for 30 minutes to evaporate methanol. After the methanol removal, the solution is heated at 310 °C under N_2 flow for 1 hour, then cooled down into room temperature. The nanoparticle was precipitated by adding ethanol to reaction mixture and washed with hexane. The UCNPs was re-dispersed and stored in cyclohexane.

B. Coating of silica on the nanocrystals

Silica coating is prepared by following previous protocol [9] with minor modification. The coating of silica on the nanocrystal is done by mixing 400 µL CO-520 and 50 mg $NaYF_4$ nanocrystal in 40 mL cyclohexane. The mixture is stirred for 10 min, then 1.6 ml CO-520 and 320 µl ammonia (wt 30%) was added. The container was sealed and sonicated for 20 min. After that, 160 µL TEOS were added into the solution, and the solution was stirred for overnight at speed of 500 rpm at room temperature. $NaYF_4$ @SiO_2 nanocrystals were precipitated by adding ethanol, and the nanocrystals were washed with ethanol/water (1:1 v/v) twice and then stored in ethanol.

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C. PEG and Amines Functionalization with hydrothermal treatment

PEG and Amines functionalization is done by following previous protocol [10] with modification. 20 mL ethanol containing 20 mg UCNP@Silica is mixed with 4 mL deionized water and 200 µL ammonium hydroxide. The mixture is stirred for 5 minutes, then 123 µL PEG-Silane$_{Mw500}$ and 47 µL APTES is added into the solution. The resulting solution is stirred at speed of 500 rpm for overnight. After that, the solution is degassed and purged with N_2 for 30 minutes, and then put inside the Teflon lined autoclave chamber. It is heated at 70 ^oC, 100 ^oC, and 200 ^oC for 48h. The resulting nanoparticles is precipitated by centrifugation and washed with ethanol/water (1:1 v/v) twice and then stored in ethanol.

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REFERENCES

[1] X. Xue et al. "Emerging functional nanomaterials for therapeutics," *Journal of Materials Chemistry*, vol. 21, no. 35, pp.13107-13127, 2011.

[2] R. He et al. "Advances of upconversion nanoparticles for molecular imaging," *Nano Biomedicine and Engineering,* vol. 5, no. 3, pp. 131-139, 2013.

[3] J. Shen et al. "Lantanide-doped upconverting luminescent nanoparticle platforms for optical imaging-guided drug delivery and therapy," *Advanced Drug Delivery Review,* vol. 65, no. 5, pp. 744-755, 2013.

[4] G. Yi et al. "Synthesis, characterization, and biological application of size-controlled nanocrystalline $NaYF_4$:Yb,Er infrared-to-visible up-conversion phosphors," *Nano Letters,* vol. 4, no. 11, pp. 2191-2196, 2004.

[5] Z. Li and Y. Zhang, "An efficient and user-friendly method for the synthesis of hexagonal-phase $NaYF_4$:Yb, Er/Tm nanocrystals with controllable shape and upconversion fluorescence," *Nanotechnology,* vol. 19, no. 34, pp. 345606-345610, 2008.

[6] C. Liu and D. Chen, "Controlled synthesis of hexagon shaped lanthanide-doped LaF_3 nanoplates with multicolor upconversion fluorescence," *Journal of Materials Chemistry,* vol. 17, no. 37, pp. 3875-3880, 2007.

[7] J. C. Boyer et al. "Synthesis of Colloidal Upconverting $NaYF_4$ Nanocrystals Doped with Er^{3+}, Yb^{3+} and Tm^{3+}, Yb^{3+} via Thermal Decomposition of Lanthanide Trifluoroacetate Precursors," *Journal of American Chemical Society,* vol. 128, no. 23, pp. 7444-7445, 2006.

[8] L. D. Sun et al. "Paradigms and Challenges for Bioapplication of Rare Earth Upconversion Luminescent Nanoparticles: Small Size and Tunable Emission/Excitation Spectra," *Accounts of Chemical Research,* vol. 47, no. 4, pp. 1001-1009, 2014.

[9] R. A. Jalil and Y. Zhang, "Biocompatibility of silica coated NaYF4 upconversion fluorescent nanocrystals," *Biomaterials,* vol. 29, no. 30, pp. 4122-4128, 2008.

[10] C. Li et al. "A facile fabrication of upconversion luminescent and mesoporous core–shell structured β-$NaYF_4$:Yb^{3+}, Er^{3+}@mSiO_2 nanocomposite spheres for anti-cancer drug delivery and cell imaging," *Biomaterials Science,* vol. 1, no. 2, pp. 213-223, 2013.

Prediction of Ceramic's Mechanical Properties Based on Sintering Temperature using Neural Network

Zulkifli[1], Detak Yan Pratama[1], Dyah Sawitri[1], Purwadi Agus Darwito[1]

Abstract – Ceramics is one of material which apply in many area. Thus, study of its properties is very important to fulfilled the properties requirement. The mechanical properties of ceramic such as flexural strength and hardness mainly depend on the sintering temperature and additive material. The experiments must be done to determine the best mechanical properties based on proportional sintering temperature and additive materials. Simulation for predicting mechanical properties of ceramics had been developed by using Artificial Neural Network. According to neural network simulation, the graphic of simulation result had same pattern to experimental data as the target. For predicting hardness, the Normalized Root Mean Square Error of network is 0 at training and 0.077 at validation part. This value is in line to its Coefficient Correlation which have value closed to 1. Meanwhile, the network can be used to predict flexural strength of ceramics excellently.

Index Terms – Artificial neural network, prediction, temperature, additive.

INTRODUCTION

Ceramic is one of the most important material in the world. There are several application which utilize ceramics, i.e. in sensor technology, electronic devices porcelain, etc. Thus, research for ceramics is important to fabricate the excellent their mechanical properties. These properties are affected on structure. While the structure is depending on the chemical composition and the following process. Thus, many experiments are needed to find proper properties

Besides, there is a simulation which similar to human neural which can be used to correlate between material compositions and following processes to it is mechanical properties. This method is called Artificial Neural Network (ANN). By using some accurate data, ANN can be used to predict mechanical properties of ceramics which are caused by chemical composition and processes

This study is discussing correlation between mechanical properties of ceramics to their chemical composition and following processes using ANN. The main ceramics which are studied had composition Al_2O_3 (90-45%), SiO_2 (10-45%), FeO_3 (0-1%), CaO (0-1%) dan TiO_2 (1-4%) which will be doped by Mullite ($3Al_2O_3.2SiO_2$). While mechanical properties of the ceramics restricted by hardness and flexural strength.

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METHOD

A. Database

Database is an important part for building the ANN. These data represent correlation between mechanical properties of ceramics as output of network and their chemical composition and processes as input of network. They used for training and validating the network. Thus, all of pairs are divided by two parts, 85% for training and 15% for validating.

B. Artificial Neural Network (ANN)

Architecture of ANN can be shown in Figure 1. It has three layers, that are input, hidden and output layer. Input of network represents Ratio of Mullite additive and temperature of sintering. Hidden layer contain hidden nodes which the number of nodes is tracked from 1 to 10. The output layer represents mechanical properties of ceramics.

Between each layer there are number which will counted and update in every epoch and called as weight. These weight will be adjusted until network gives the best of performance indicator. Hidden and output layers of this network have activation function for calculating the data from layer preceding layer and weight between them. Activation layer of hidden layer is tangent sigmoid and the output layer is linear. Backpropagation method is used for adjusting the weight and Lavenberg Marquardt (LM) as the training algorithm.

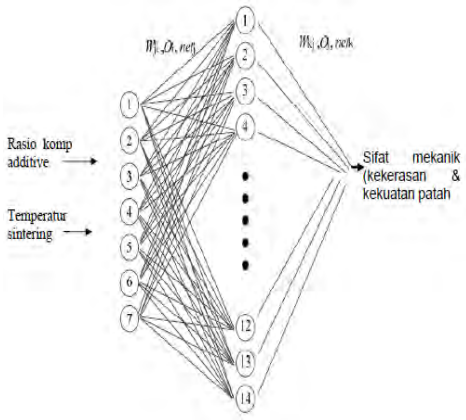

Figure 1. Architecture of Artificial Neural Network.

RESULT AND ANALISYS

Training and validating network for predicting hardness of ceramics had been accomplished. In training part, the network give NRMSE value of 0, which mean the minimum value of NRMSE. Simultaneously, network show best performance of coefficient ratio when it had raised 1. Moreover, at the validation part, the network also gives excellent

performance when NRMSE value is 0.077 and R value is 0.94.

Figure 2 show the comparison of simulation results and target data. Those figure shows that the simulation data have same pattern to experimental data as target. They show that network can be used to predict the hardness properties of ceramics.

Prediction of flexural strength of ceramics also has been done when network has NRMSE 0 for training and 0.094 for validation. Also, performances in R value explain that network has R value 1 for training and 0.981 for validation. Thus, from these values, network can be confirmed that can be used to predict flexural strength of ceramics. Simulation of prediction network which is compared to experimental data as target can be shown on Figure 3.

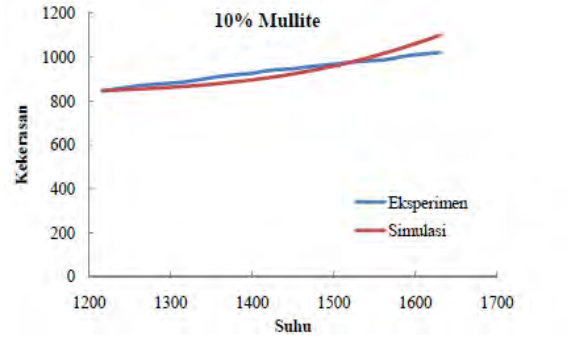

Figure 2. Comparison of simulation and target value for hardness prediction of ceramics

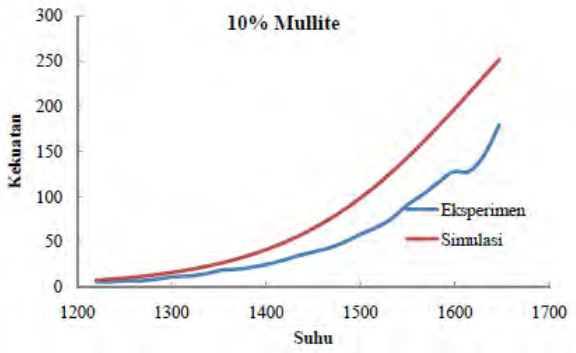

Figure 3. Comparison of simulation and target value for flexural strength prediction of ceramics

CONCLUSION

Neural network has been built to predict flexural strength and hardness of ceramics. Performance in training and validation prove that NN can predict both of these mechanical properties. NRMSE values are closed to 0 and R values are closed to 1.

REFERENCES

[1] Hari Subiyanto, Subowo, "Pengaruh temperatur sintering terhadap sifat mekanik keramik Insulator Listrik". Jurnal Teknik Mesin FTI-ITS,volume 3, No 1 Januari 2003

[2] Zhecheva, A., Malinov, S. & Sha, W. 2005. Simulation of Microhardness Profiles of Titanium Alloys after Surface Nitriding using Artificial Neural Network. Surface & Coating Technology 200: 2332-2342.

Stability Control Design of Sigma Class Ship Firing Mode using Fuzzy Gain Scheduling-PID

Ii Munadhif[1], Aulia Siti Aisjah[1], A.A. Masroeri[2]

Abstract – Sigma class ship of Hasanuddin 366 is one of Indonesian battle ship. When the ship operates, shipwreck can be happened because impact force disturbance can increase the angle of yaw and roll. In this research, the system of rudder roll stabilization is designed to keep the ship heading/yaw and decrease the roll angle using ship nonlinear dynamic model of 4 degree of freedom (DOF) that contains surge, sway, yaw, and roll. Fuzzy gain scheduling–PID (FGS-PID) controller is used to control rudder angle as the steering control. The value of the cannon impact force disturbance is 1062.525 Newton with angle variation of 30o from the direction of ship surge. The FGS-PID controller is compared with the PID Ziegler Nichols (PID-ZN) controller as reliability test. According to simulation result, the FGS-PID controller is better than PID-ZN in keeping the heading and decreasing the roll. The performance of FGS-PID controller with heading input of 20o and 30o is compatible with the stability parameter of IMO (International Maritime Organization).

Index Terms – KRI Hasanuddin 366, rudder roll stabilisation, 4DOF, FGS-PID controller, PID-ZN controller.

INTRODUCTION

KRI Hasanuddin 366 is one of Indonesian battleship that is used in maritime defense [1]. Great maneuvering capability is needed in this ship to keep the ships stability. The steering/rudder system is the actuator to control ship heading/yaw angle and decrease ship roll angle. In operating mode, the threshold standard of this battle ship are 28o of ship dynamic rolling trim angle and wave disturbance of sea state 6 [2]. In this research, the system uses the Otomelara 76 as model of cannon impact force internal disturbance. FGS-PID is used as controller by using its capability to adapt in environment change and its ability to determine PID parameters in order to decrease the error signal to the desired value [3].

METHOD

A. The Specification Data of KRI Hasanuddin 366

The detail of KRI Hasanuddin 366 specification is described in table 1.

Table 1. Ship Specification Data [2].

Specification	Size
Overall Length of the Ship (L_{OA})	90.71 m
Length between perpendiculars (L_{pp})	84 m
Breadth (B)	13.02 m
Breadth of the Waterline (B_{WL})	12.21 m
Mass of Ship (m)	1.818×10^6Kg
Velocity (U)	9.53 m/s
Draught (D)	3.5 m
Volume of Displacement (∇)	1793 m^3
Coefficient Block (CB)	0.491
Nominal inertia in roll (I_{xx})	2.43×10^7Kgm^2
Nominal inertia in yaw (I_{zz})	1.07×10^8Kgm^2

B. The Ship Model

Perez [4] ship nonlinear dynamic model of 4 degree of freedom (DOF) is used. The model is then transformed into the state space matrix.

$$\begin{bmatrix} \dot{v} \\ \dot{p} \\ \dot{r} \\ \dot{\phi} \\ \dot{\psi} \end{bmatrix} = \begin{bmatrix} -0.8563 & 0.026367 & 0.889808 & 1.351474 & 0 \\ 0.006979 & -0.121443 & -0.137992 & -6.249712 & 0 \\ 0.000447 & 0.00005 & 0.006931 & 0.0003715 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} v \\ p \\ r \\ \phi \\ \psi \end{bmatrix} + \begin{bmatrix} 0.420918 \\ 0.023502 \\ 0.008185 \\ 0 \\ 0 \end{bmatrix} \delta \quad (1)$$

C. Cannon Impact Force Disturbance Model

The principal of the third Newton Law is used to determine the firing cannon impact force.
Cannonball specification:
Cannonball velocity (V_p) = 442.7188 m/s,
Impact force / impulse force (Fi) = 1062.525 N
Horizontal direction force (Fa) of Fi = Ficos45 = 751.318 N. If ai = 30o , then $Fsway$ = Fasin30 = 375.659 N

D. Rudder Model

The Rudder type of sigma class battle ship that is considered in this research is the type of Van Amorengen with rudder limiter of -35° – 35° and rudder rate limiter of -7°/s – 7°/s [5].

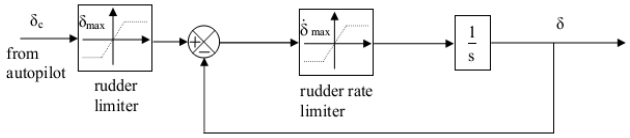

Figure 1. Rudder block diagram

E. Rudder Roll Stabilization

Rudder roll stabilization is one of the devices to control the angle of yaw and roll. The rudder signal is the additions result of the output of yaw and roll controller. The rudder roll stabilization block diagram is shown in figure 2.

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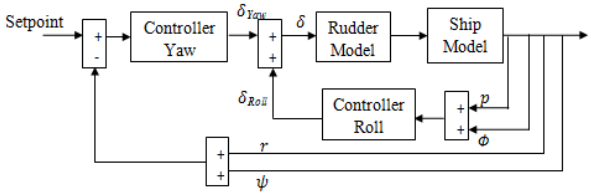

Figure 2. Rudder roll stabilization block diagram

RESULT AND DISCUSSION

The close loop system uses the step function as input. The regulation of International Maritime Organization (IMO) states the heading angle input to be 20º and 30º. This simulation uses the heading angle input of 30º. The cannon is assumed to be fired once with 2 seconds of time delay after the heading has started. Figure 3 and 4 show the response of cannon impact disturbance of yaw and roll.

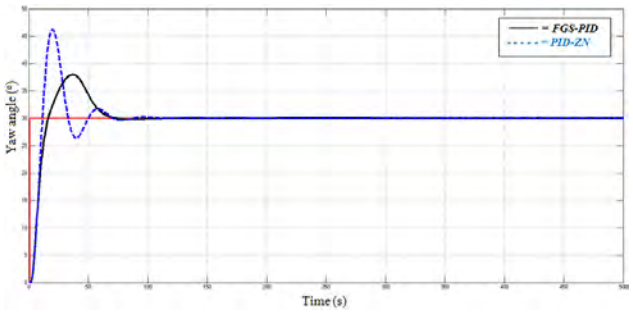

Figure 3. Yaw response of cannon impact disturbance 30º heading 30º.

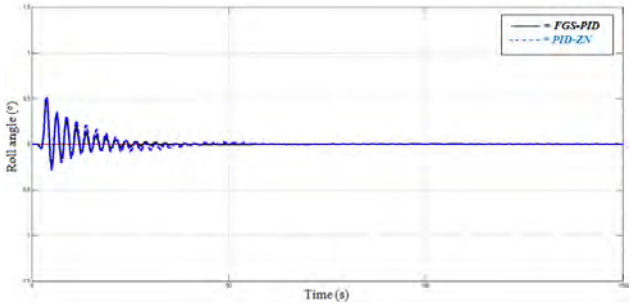

Figure 4. Roll response of cannon impact disturbance 30º heading 30º.

Table 2. Response of disturbance 30º and wave state 1

Controller	Maximum *over shoot* (%)	Settling time (s)	RMSE *yaw over all*	*Roll steady state* (s)
FGS-PID	26.556	64.694	4.599	42
PID-ZN	54.07	67.228	9.656	66

Figure 3 and 4 and table 2 shows that FGS-PID controller is more reliable since its maximum overshoot and the RMSE yaw over all are less, and also the settling time and roll steady state are faster than the result of PID-ZN controller.

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REFERENCES

[1] Himam, M. Faikhul. (Letda Laut). *Kri Sultan Hasanudin 366*. Satuan Kapal Eskorta Ko-Armatim. 2013.

[2] Sari, Devina P. *Perancangan Sistem Kendali Kestabilan Rolling Kapal Perang KRI Korvet Sigma Pada Saat Fireing Sistem Berbasis Logika Fuzzy*, Thesis, 10 November Institute of Technology, 2013.

[3] Zhao, Zhen. Tomizuka, Masayoshi. Isaka, Satoru. *Fuzzy Gain Scheduling of PID Controllers,* IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS, VOL 23, NO.5. pp. 1392-1399, 1993.

[4] Perez, Tristian. *Ship Motion Control*. Springer, London. 2005.

[5] Fossen, Thor. I. *Guidance and Control of Ocean Vehicle*. John Willy & Son, Ltd. Chichester, New York, Brisbane, Toronto, Singapore, 1994.

[6] J. G. Ziegler and N. B. Nichols, *Optimum settings for automatic controllers*, Trans. ASME, vol.64, pp. 759-768, 1942.

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